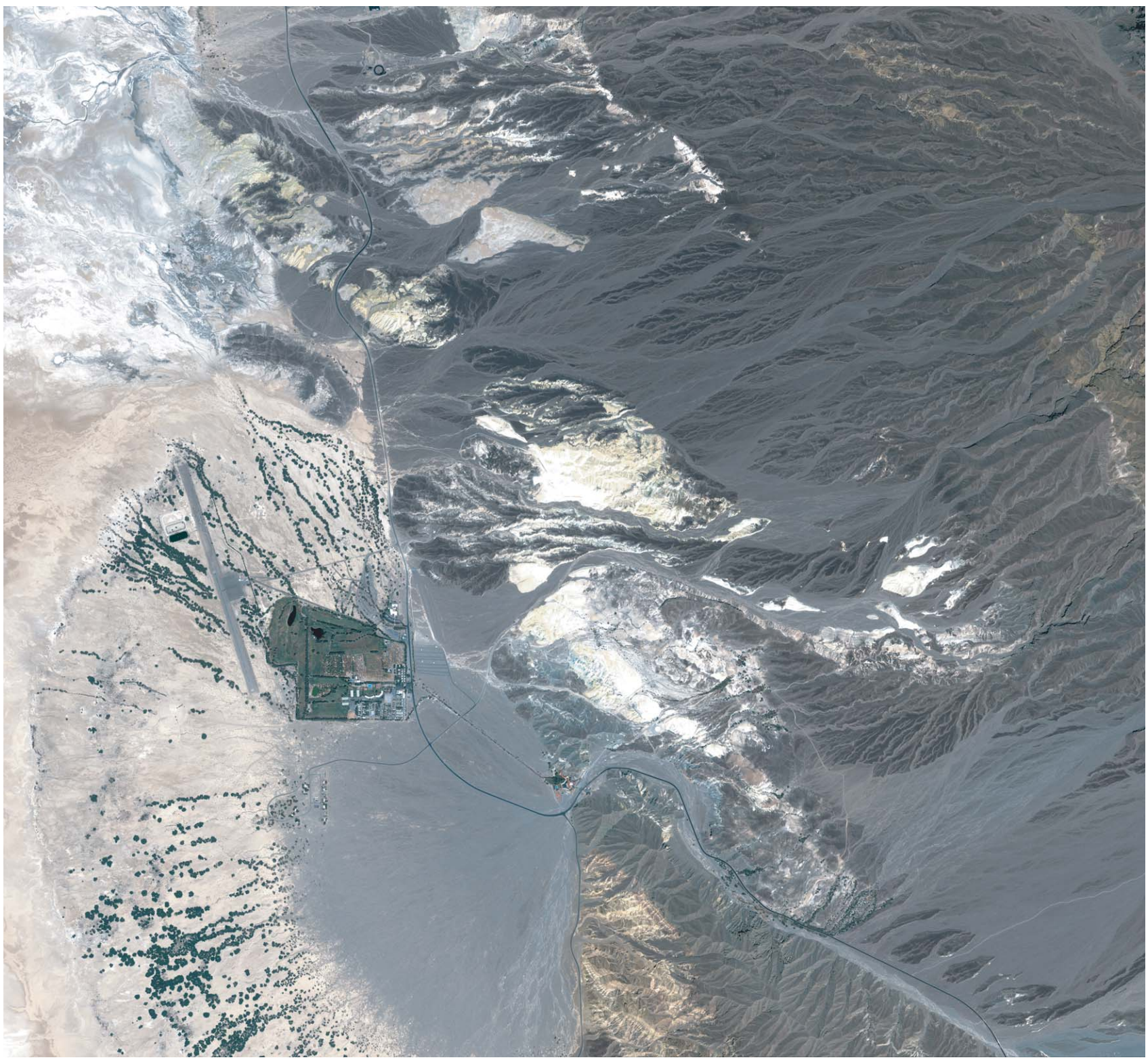
Death Valley National Park

National Park Service
U.S. Department of the Interior

Reconstruction of the Furnace Creek Water Collection System

Draft Environmental Impact Statement
October 2005



United States Department of the Interior

NATIONAL PARK SERVICE
Death Valley National Park
Death Valley, California 92328

IN REPLY REFER TO:
088691 (DEVA)

October 2005

Dear Friends:

On behalf of the National Park Service, I am pleased to present the Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement. The Reconstruction of the Furnace Creek Water Collection System project is located in the Furnace Creek area of Death Valley National Park, California. The proposed project would rebuild the outdated water collection system in the Furnace Creek area to deliver a safe and reliable potable and nonpotable water supply to the park's main visitor use area.

Public and agency participation has been incorporated in this planning process. Death Valley National Park held public scoping and informal meetings in 2001 through 2005 to solicit ideas and concerns from park visitors, park staff, Native American groups, scientists, and government agencies. The planning team reviewed public comments and identified a range of issues and concerns. This information was used to develop the alternatives and analysis in this Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement.

There will be a 60-day comment period on the environmental impact statement. If the environmental impact statement and a record of decision are approved, project construction is expected to begin in spring 2007. We appreciate your interest in this planning effort and welcome your participation. The 60-day opportunity for public comment begins with the Environmental Protection Agency filing of a Notice of Availability in the Federal Register. Written comments must be received during the 60-day public comment period and should be directed to:

Mail: Superintendent, Death Valley National Park
ATTN.: Reconstruction of the Furnace Creek Water Collection System
Death Valley, California 92328

Fax: 760/786-3283

Email: Deva_Superintendent@nps.gov

Written comments will also be accepted at National Park Service planning meetings to be held in Pahrump, Nevada and at Furnace Creek Visitor Center in Death Valley National Park, California. The exact dates, locations, and times of the meetings will be announced in the Notice of Availability and in the regional and local news media.

This document can be viewed on the internet at *www.nps.gov/deva/pphtml/documents.html*. To request a printed copy of this document, refer to the information directly above or phone 760/786-3243.

Sincerely,

for James T. Reynolds
Superintendent

Death Valley National Park

Lead Agency: National Park Service
Cooperating Agency: Timbisha Shoshone Tribe

ABSTRACT

This Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement is intended to guide the redevelopment of the water collection and distribution system in the Furnace Creek area in Death Valley National Park. The current water collection system consists of four water collection boxes at Travertine Springs, a collection gallery in Furnace Creek Wash, a tunnel for water collection constructed similar to a mine adit at Texas Springs, and a tunnel for water collection constructed similar to a mine adit at the Furnace Creek Inn (Inn Tunnel). All water distributed by the existing collection system, except that collected at the Inn Tunnel, is potable, although much of the water is used for irrigation and other nonpotable purposes. The environmental impact statement identifies and analyzes 4 alternatives, including the No Action Alternative (Alternative 1) and the Preferred Alternative (Alternative 3).

The No Action Alternative represents the status quo; the existing facilities would remain unchanged except for normal maintenance and repair. It provides the basis for comparison of each action alternative. Alternative 2, Alternative 3, and Alternative 4 (the action alternatives) would rebuild the outdated water collection system in the Furnace Creek area to deliver a safe and reliable potable and nonpotable water supply to the park's main visitor use area. All three action alternatives would separate the potable and nonpotable water system in the project area and provide nonpotable water from the Inn Tunnel and a relocated Furnace Creek Wash collection gallery. Alternative 2 would provide potable water from rebuilt collection galleries at Travertine Springs Lines 3 and 4 and two new groundwater wells in the Texas Springs Syncline. Alternative 2 would treat water collected for potable purposes using a reverse osmosis water treatment plant, and would dispose of concentrate water from the water treatment plant into a percolation trench in Furnace Creek Fan. Alternative 3 (Preferred) would provide potable water from two to three new groundwater wells in the Texas Springs Syncline. Alternative 3 would treat water collected for potable purposes using a reverse osmosis water treatment plant, and would dispose of concentrate water from the water treatment plant into a percolation trench in Furnace Creek Wash. Alternative 4 would provide potable water from Travertine Springs Lines 2, 3, and 4 and Texas Springs. Alternative 4 would treat water collected for potable purposes using a reverse osmosis water treatment plant (including treated bypass water), and would discharge concentrate water to a tributary of Texas Springs Wash. Each of the action alternatives would install a number of groundwater monitoring wells.

Death Valley National Park

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Reconstruction of the Furnace Creek Water Collection System

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Furnace Creek area from the air looking east, 1936. Photo by Spence Air Photos, courtesy U.S. Borax and Chemical Corporation, catalog number FCI-39.

Executive Summary

Introduction

The Furnace Creek area is located in the central region of Death Valley National Park (the park) in Inyo County, California. The National Park Service (NPS), Xanterra Parks and Resorts (Xanterra), and the Timbisha Shoshone Tribe (tribe) are the primary water user groups in the Furnace Creek area. The Texas-Travertine Springs complex in the Furnace Creek area may be the most critical water resource in Death Valley National Park. This series of springs provides water for all of the human use needs in the park headquarters area. Major infrastructure in this area includes the primary National Park Service administrative offices, three National Park Service campgrounds, two private resort/visitor services facilities owned and operated by Xanterra, and the offices and residences for the Timbisha Shoshone Tribe. The Texas-Travertine Springs complex also provides water that supports a riparian area, a biological community that includes habitat for a minimum of eight endemic special-status species, and a biologically and culturally-important mesquite bosque.

The current water collection system consists of four water collection boxes at Travertine Springs, a collection gallery in Furnace Creek Wash, a tunnel for water collection constructed similar to a mine adit at Texas Springs, and a tunnel for water collection constructed similar to a mine adit at the Furnace Creek Inn. All water distributed by the existing collection system is potable, although much of the water is used for irrigation and other nonpotable purposes. The existing water collection system was installed in the 1970s, and has been unreliable, subject to failure, and is nearing the end of its useful life span. Many of the existing collection galleries have intermittently tested positive for coliform or E. coli bacteria, experienced unpredictable inputs of soil or organic matter, intermittently and unpredictably produced reduced volumes of water, and collected groundwater that does not meet state drinking water standards. When the system was installed approximately 30 years ago, there was an incomplete understanding of the Furnace Creek area's unique biological resource values and water conservation strategies were not a priority.

The National Park Service proposes to rebuild the antiquated water collection system in the Furnace Creek area to deliver safe and reliable drinking water to the park's main visitor use area, and provide separate delivery systems for potable and nonpotable water. As part of the redevelopment of the Furnace Creek water collection system, the National Park Service proposes to restore historic wetland and riparian habitat, and ensure the long-term conservation of species endemic to the Furnace Creek area.

The Timbisha Shoshone Tribe is a cooperating agency (as defined by the Council on Environmental Quality National Environmental Policy Act [NEPA] Regulations Section 1501.6) in the preparation of this environmental impact statement. The Timbisha Shoshone Tribe has tribal lands in the Furnace Creek area, and has water rights for the Timbisha Shoshone residential and administrative area pursuant to the Timbisha Shoshone Homeland Act. The California Department of Transportation (Caltrans) is a stakeholder in this planning process due to the proximity of the project to Highway 190. Xanterra Parks and Resorts also is a stakeholder in this planning process. Xanterra is an inholder in Furnace Creek, owner and operator of the Furnace Creek Inn and Furnace Creek Ranch, and has water rights pursuant to a 1969 agreement between the United States of America and Fred Harvey, Inc.

Organization of this Environmental Impact Statement

The preferred and alternative plans for the Reconstruction of the Furnace Creek Water Collection System and its environmental impact statement (EIS), which evaluates the potential impacts of the alternatives, are integrated in this document and will be referred to collectively as the Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement. The contents of the main body of this document are as follows:

Chapter I: Purpose and Need

This first chapter of the EIS includes a discussion of the project's background, purpose and need, planning context, cooperating agencies and stakeholders, public involvement, planning issues, impact topics analyzed in this EIS, and impact topics dismissed from further analysis in this EIS.

Chapter II: Alternatives

This chapter presents the project alternatives considered by the National Park Service for the Reconstruction of the Furnace Creek Water Collection System, as well as the alternatives considered but dismissed from further analysis. This chapter includes summary tables of the key features of the four project alternatives, and an environmental consequences summary table at the end of the chapter.

Chapter III: Affected Environment

This chapter provides an overview of the affected environment of the Furnace Creek system and its surroundings. The affected environment provides a description of the existing condition of geologic resources, geologic hazards, paleontological resources, hydrology, water quality, wetlands, vegetation, wildlife, special-status species, air quality, soundscapes, cultural resources, visitor experience, transportation, scenic resources, socioeconomics, and park operations and facilities in the Furnace Creek area.

Chapter IV: Environmental Consequences

This chapter presents an analysis of the potential environmental impacts of each alternative, including impact context, duration, intensity, and type. Chapter IV, Environmental Consequences, presents an analysis of cumulative impacts, as well as an analysis of potential impairment of park resources resulting from the alternatives.

Chapter V: Consultation and Coordination

This chapter summarizes the process relied upon in preparing and reviewing this document. This chapter provides a brief history of public involvement, a list of preparers and reviewers and their expertise, and a list of recipients of the EIS.

Chapter VI: References

This chapter identifies the references used in preparing the EIS, including the document bibliography, glossary, and index of key words.

Purpose and Need for the Action

Purpose of the Project

The National Park Service is considering rebuilding the water collection system in the Furnace Creek area of Death Valley National Park. The purpose of the action is to:

- Provide a reliable quality and quantity of potable water for the National Park Service, Xanterra resort facilities (i.e., the Furnace Creek Inn and Furnace Creek Ranch), Timbisha Shoshone Tribe, and park visitors.
- Promote the conservation of biological and cultural resource values in the Texas-Travertine Springs area.
- Enhance water resource protection and management in the Furnace Creek area.

Need for the Project

This action is needed because the existing water collection system:

- Experiences unpredictable fluctuations in the volume of water that is produced. In the spring of 1998, an underground water collection gallery in Furnace Creek Wash nearly went dry even though it had produced 720,000 gallons of water per day for several years. The cause of this facility failure is believed to have been the result of channel down cutting that occurred after a flash flood in the Furnace Creek area. The down cutting event is believed to have lowered the water table below the level of the collection gallery. The resulting loss of 720,000 gallons of water per day was approximately equal to a 36% reduction in the amount of water that was available for domestic use. Since 1998, Furnace Creek Wash has resumed water supply consistent with historic water production levels.
- Produces a quality of water that does not meet state drinking water standards. Over the past several years, five of the six water collection sources have tested positive for total coliform bacteria and some of the collection sources have had documented cases of E. coli bacteria. The detection of E. coli bacteria in the drinking water supply is especially problematic, and has resulted in the issuance of emergency "boil order" notifications that have severely disrupted the delivery of water to the primary visitor use area in the park. In addition, arsenic concentrations do not meet the newly adopted federal drinking water standards for arsenic, and the system's potable water exceeds state standards for fluoride.
- Has resulted in the loss of historic wetland and riparian habitat in the Furnace Creek area. In the summer of 1999, various collection galleries in the Texas-Travertine Springs complex were systematically taken off-line because of concerns related to the presence of bacteria in the water supply. This action resulted in a condition where water that would normally have been diverted to the domestic water supply was instead released to the local environment. Park resource management staff used a Global Positioning System to accurately map the length of stream segments with and without the effects of water diversion activities and determined that Furnace Creek water collection activities are collectively responsible for the loss of seven linear miles of stream habitat when the collection galleries are fully operational.
- Provides limited flexibility for restoring habitat and species that are endemic to the Furnace Creek-Cow Creek area. Many of the existing collection galleries do not possess overflow pipes that automatically release water to the surrounding environment. The areas down-gradient of these collection galleries are largely dry, resulting in a decrease in the presence and extent of water-dependent plant and animals that were historically present. There is a limited ability to use the current infrastructure to return flows to the local environment.

- Requires the collection of water through the use of buried collection galleries dependent on two management practices that could adversely affect local plant and animal species. Park staff periodically need to replace buried collection pipes that become occluded with tree roots. This maintenance process is necessary to ensure the collection of a consistent amount of water, but typically requires the disturbance of a moderately large area in order to access and replace obstructed pipes. Proper maintenance of collection galleries also requires that the areas over the top of collection galleries be maintained in a manner that is devoid of woody vegetation. This practice is necessary in order to eliminate/reduce the presence of plant roots that promote the presence of total coliform bacteria in the water supply.
- Does not provide adequate quantification of the amount of water leaving the potable water storage tanks. The current water distribution infrastructure does not possess flow gauges that permit a fully accurate or complete accounting of the volume of water that is delivered to different water user groups or destination points. This has resulted in difficulties documenting whether each user group receives the amount of water that they are entitled to and determining where water conservation measures could be developed and implemented.

An EIS analyzes the alternatives for the proposed actions and their impacts on the environment. This EIS has been prepared in accordance with NEPA, regulations of the Council on Environmental Quality (40 Code of Federal Regulations [CFR] 1508.9), and the National Park Service's Director's Order-12 (Conservation Planning, Environmental Impact Analysis, and Decision-making), and the National Historic Preservation Act (NHPA) of 1966, as amended, implementing regulations in 36 CFR Part 800.

Relationship to Other Plans

The Death Valley National Park *General Management Plan* is the guiding document for this environmental impact statement. The Reconstruction of the Furnace Creek Water Collection System is an implementation plan that tiers from the *General Management Plan* while complying with other applicable planning documents and regulations that govern land use within Death Valley National Park.

Management Goals

The development of the Reconstruction of the Furnace Creek Water Collection System in a manner that meets local user group's water needs and provides for the perpetuation and restoration of water-dependent habitats and species would fulfill several management goals of the National Park Service. These goals have been described to varying degrees in the park's enabling legislation, *General Management Plan*, California Desert Protection Act, and the National Park Service *Management Policies 2001*.

Redevelopment of the Furnace Creek water collection system would achieve the following goals:

- Ensure the existing biological and cultural resources values are preserved and that historical habitats are restored to the extent that is feasible
- Meet the legal water entitlements of local user groups, i.e., the National Park Service, Xanterra Parks and Resorts, and the Timbisha Shoshone Tribe
- Provide potable water that meets California and federal water quality standards
- Improve and enhance water resource protection and management, and the efficiency of water use

- Technologically facilitate the monitoring of the volume of water that enters and leaves the water collection system
- Provide the flexibility to divert water from different water sources as natural resource and maintenance needs dictate
- Ensure that the water collection system is designed to facilitate periodic maintenance activities with a minimum of environmental disturbance or elevated maintenance costs
- Address highway safety concerns of the California Department of Transportation

Water Conservation Measures

In accordance with park practices, the National Park Service would continue to incorporate water conservation measures at park facilities, including low-flow toilets, drip irrigation systems, xeric landscape planting, etc., and encourage the adoption of water conservation measures by local user groups in Furnace Creek independently of the Reconstruction of the Furnace Creek Water Collection System.

Planning Issues

Planning issues were developed from concerns raised during the public and agency scoping process, and from National Park Service staff, the Timbisha Shoshone Tribe (cooperating agency), Caltrans (stakeholder), and Xanterra (stakeholder). Primary planning issues are briefly summarized below. A complete discussion of planning issues is included in the Planning Issues section of Chapter I, Purpose and Need. The first set of issues, "Issues Addressed in this Environmental Impact Statement," includes those issues specifically related to the project alternatives and addressed in this EIS. The second set of issues, "Issues Not Addressed in this Environmental Impact Statement," includes issues that are addressed in other park plans and those that are beyond the scope of this project.

Issues Addressed in this Environmental Impact Statement

The alternative that is ultimately selected to provide water for the Furnace Creek area would need to balance and address a variety of management concerns and issues that include federal and state drinking water standards, water resource protection and management issues, water user group needs, protection of endemic species habitat, maintenance of riparian plant communities, long-term facility maintenance needs, and Caltrans highway safety concerns.

Endemic Invertebrate Species

The Furnace Creek area is home to numerous endemic invertebrate species found nowhere else in the world. Plant and animal species that exist in Death Valley have developed unique survival techniques to adapt to this desert environment. The Reconstruction of the Furnace Creek Water Collection System should ensure the preservation of the park's biological resources, including the protection and restoration of endemic invertebrates.

Highway 190

Highway 190 traverses the Furnace Creek area and is one of the primary access roads to the park. Flash floods and spring releases have periodically damaged Highway 190 and disrupted this park transportation corridor, including the August 2004 flood. In addition, the Furnace Creek Wash

measurement box, a primary component of the park's water collection system, is located adjacent to Highway 190 and is susceptible to damage or contamination in the event of a highway accident.

Water Quality

Water quality has been a concern with the existing water collection system. The Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement addresses the provision of a reliable quantity of potable water that meets federal and state water quality standards.

Water Supply

The Furnace Creek water system is the sole provider of water to the Furnace Creek area. The antiquated water system at Furnace Creek has not provided a reliable quantity or quality of water to local users and park visitors. The National Park Service has legal obligations to provide designated amounts of water to Furnace Creek users (i.e., Xanterra and the Timbisha Shoshone Tribe) pursuant to legal water entitlements held by these users, as described in Appendix B, Water Rights. The Reconstruction of the Furnace Creek Water Collection System alternatives must meet the legal water entitlements of the local user groups. The National Park Service needs to ensure consistent provision of water that meets water quality standards to users during construction and project operation. A range of alternate designs was considered to accommodate the water supply volumes required by legal entitlements of local user groups. The Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement addresses water storage for fire protection purposes.

Dual Water System

The Furnace Creek water system provides predominantly potable water to users, with the exception of Inn Tunnel water. The Reconstruction of the Water Collection System Environmental Draft Impact Statement alternatives should develop a dual water system that provides separate potable and nonpotable water.

Water Metering

The antiquated Furnace Creek water collection and distribution system was not configured to accurately monitor quantities of water distributed to water users. The Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement alternatives improve the accuracy of systems designed to monitor water distribution and use.

Water Resource Protection and Management

The alternatives would affect the National Park Service's ability to manage and protect water resources within the Furnace Creek area of Death Valley National Park. The action alternatives include the installation of groundwater monitoring wells. These wells would be used in conjunction with existing wells to assist the National Park Service in water resource protection and management by enhancing understanding of groundwater levels and flow patterns in the Texas Springs Syncline aquifer, and the effect changes in groundwater levels may have on springs in the Furnace Creek area.

Issues Not Addressed in this Environmental Impact Statement

Legal Water Entitlements to Furnace Creek Users

The National Park Service has legal obligations to provide designated amounts of water to Furnace Creek users (i.e., Xanterra and the Timbisha Shoshone Tribe) pursuant to legal water entitlements held by these users, as described in Appendix B, Water Rights. The National Park Service will continue to allot water to Xanterra and the Timbisha Shoshone Tribe consistent with these legal entitlements. The provision of water to these user groups by the National Park Service associated with the Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement would not modify these legal entitlements. Similarly outside the scope of this draft environmental impact statement is how Xanterra and the tribe choose to use the water to which they are legally entitled. As a result, use of water in Furnace Creek for swimming pools and golf course irrigation and implementation of water conservation measures for Xanterra and tribe water use are outside the scope of this environmental impact statement.

Overview of the Alternatives

The Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement presents and analyzes four sets of proposals, referred to as the alternatives. The No Action Alternative represents management direction and conditions as they currently exist in the project area. The three action alternatives represent a reasonable range of options to satisfy the purpose of and need for the project, while also meeting all relevant project goals. The action alternatives aim to achieve the goals of this project, but vary in their proposals for the Reconstruction of the Furnace Creek Water Collection System.

The National Park Service has identified Alternative 3 as the preferred alternative. It satisfies the purpose of and need for the action, accomplishes the project goals, protects resources, and complies with the goals of the *General Management Plan*. Meeting the requirements of the *General Management Plan* complies with the National Park Service Organic Act and Death Valley National Park enabling legislation. The selection of a final alternative will be documented in a Record of Decision.

The No Action Alternative represents the status quo; the existing facilities would remain unchanged, except for normal maintenance and repair. It provides the basis for comparison of each action alternative. Alternative 2, Alternative 3, and Alternative 4 (the action alternatives) would rebuild the outdated water collection system in the Furnace Creek area to deliver a safe and reliable potable and nonpotable water supply to the park's main visitor use area. All three action alternatives would separate the potable and nonpotable water system in the project area, and provide nonpotable water from the Inn Tunnel and a relocated Furnace Creek Wash collection gallery. The alternatives are summarized briefly below. A summary of the environmental consequences of the alternatives is included in table ES-1.

Alternative 1 (No Action)

The No Action Alternative maintains the status quo for the Furnace Creek water collection system. It provides a baseline from which to compare the action alternatives, to evaluate the magnitude of proposed changes, and to measure the environmental effects of those changes. This no action concept follows the guidance of the Council on Environmental Quality, which

describes the No Action Alternative as representing no change from the existing management direction or level of management intensity.

Under the No Action Alternative, the Furnace Creek water collection system would remain in its existing condition. Necessary maintenance and repairs would continue, but no major undertakings (e.g., maintenance activities) would occur. Alternative 1 would provide potable water from collection galleries at Travertine Springs Lines 2, 3, and 4, and Furnace Creek Wash. Nonpotable water and groundwater recharge would be provided from the Inn Tunnel. Riparian water would be released from Travertine Springs Line 1 and Texas Springs. Alternative 1 would continue to store water in a 2-million gallon storage tank and a 500,000 gallon storage tank.

As shown in table II-1 in Chapter II, Alternatives, Alternative 1 would provide approximately 1,177 gallons per minute (gpm) of potable water, 145 gpm of nonpotable water, 335 gpm of riparian water, and 155 gpm of water for groundwater recharge. [1] Water intended for potable use would be disinfected through chlorination treatments at the 2-million gallon water storage tank.

Alternative 2

Alternative 2 would provide potable water from rebuilt collection galleries at Travertine Springs Lines 3 and 4, and 2 new groundwater wells in the Texas Springs Syncline. Alternative 2 would treat water collected for potable purposes using a reverse osmosis water treatment plant, and would discharge concentrate water from the water treatment process to a percolation trench in Furnace Creek Fan for groundwater recharge. Nonpotable water would be provided from a rebuilt Furnace Creek Wash collection gallery as well as from the Inn Tunnel. Riparian water would be released from Travertine Springs Lines 1 and 2 and Texas Springs to restore historic wetland and riparian habitat. The restoration effort would include the incorporation of riparian water release measures that would reduce erosion and promote groundwater infiltration.

Under Alternative 2, maximum daily flow requirements would need to be met approximately 10% of a calendar year. The average daily flow requirements would need to be met 100% of the calendar year, and would constitute the water withdrawals from the Furnace Creek system approximately 90% of the year. To meet maximum daily flow requirements, Alternative 2 would collect approximately 600 gpm of potable water and 900 gpm of nonpotable water, and release approximately 663 gpm of riparian water. Approximately 120 gpm of concentrate water from the reverse osmosis water treatment plant would be discharged to a percolation trench for groundwater recharge (see table II-1 in Chapter II, Alternatives). To meet average daily flow requirements, Alternative 2 would collect approximately 429 gpm of potable water and 780 gpm of nonpotable water, and release approximately 663 gpm of riparian water. Approximately 86 gpm of concentrate water would be discharged for groundwater recharge (see table II-2 in Chapter II, Alternatives). Under average daily flow requirements, less potable water would be pumped from the proposed groundwater wells.

The exact effects of groundwater pumping are unknown at this time; however, discharges from spring outlets would be expected to decline as the groundwater flow system reaches a new equilibrium. Computer modeling of the Texas Springs Syncline aquifer indicates that the overall

[1] Flow rates and water usage identified under each alternative associated with water draws from Travertine and Texas Springs, Furnace Creek Wash, the Inn Tunnel, and the proposed groundwater production wells (under Alternatives 2 and 3) would be approximate. These flow rates would be used for water collection system design purposes, and actual flows may vary slightly.

reduction in flow from Travertine and Texas Springs system is expected to equal the volume of groundwater pumped under the average daily demand scenario (Bredehoeft et al 2005). The response to groundwater pumping would likely not occur immediately at the springs, as the National Park Service expects a time lag between the initiation of groundwater pumping and the effects observed at the springs and other discharge points. The length of the time lag could range from months to years and would depend upon the pumping rate and subsurface hydrogeologic conditions, which are not fully characterized. Full impacts of groundwater pumping may not be observed for 10 to 20 years after pumping begins. Due to the hydrogeologic conditions of the area, it would be likely that the effects would be spread reasonably evenly throughout discharge points in the Furnace Creek area; however, there may be some variation in the effect at individual discharge points because of the local differences in aquifer hydraulic properties and the distance of the discharge points from the groundwater pumping wells.

The average daily flow requirements may decrease discharges from spring outlets. Based on an average water usage rate of 343 gpm of potable water (requiring 429 gpm of raw water with approximately 300 gpm provided by Travertine Springs Lines 3 and 4, and approximately 129 gpm supplied by groundwater wells) and computer modeling of the Texas Springs Syncline aquifer, the National Park Service estimates that discharges from the spring system may decrease an average of approximately 7% under Alternative 2 (NPS 2004c,d).[2] Flows from Travertine Springs Line 1 and Line 2 would be reduced to 126 gpm and 351 gpm, respectively. Flows from Texas Spring would be reduced to 186 gpm. Reconstruction of the Travertine Springs Line 3 and Line 4 spring boxes would likely improve the water collection capabilities at these springs, and therefore the spring output at these sources would not be reduced by 7%.

Groundwater pumping from production wells in the Texas Springs Syncline would not be anticipated to reduce flows from the Inn Tunnel or Furnace Creek Wash collection systems by 7% as these systems draw upon groundwater flowing in the alluvium of Furnace Creek Wash. Groundwater availability in Furnace Creek Wash would be affected by a decrease in flow from Travertine Springs due to groundwater pumping from the syncline; however, net groundwater flow in Furnace Creek Wash would be enhanced by increased riparian releases at Travertine Springs Line 2. In addition, reconstruction of the Furnace Creek Wash collection gallery would improve the water collection capabilities.

The increased groundwater pumping to meet maximum daily flow requirements (i.e., 300 gpm vs. 129 gpm from production wells) would not be expected to substantially affect discharge from the spring system due to the short-term and episodic nature of these well pumping requirements. A temporary reduction of spring discharge, due to pumping to meet maximum daily demand requirements, could be superimposed on the existing reduction caused by the average pumping rate; however, it is anticipated that the effects of maximum daily demand pumping would be dampened and attenuated by the time those stresses would be observed in spring discharge. The National Park Service would select a pumping schedule that would minimize fluctuations in water levels (i.e., use a low pumping rate over a longer period of time rather than a high pumping rate over a shorter period of time) when feasible.

[2] It is estimated that an average of 129 gpm would be pumped from the proposed groundwater wells under this alternative, which would be approximately 7% of total flow (i.e., 1,812 gpm) collected or discharged from the Furnace Creek system under the No Action Alternative.

Alternative 3 (Preferred)

Alternative 3 (Preferred) would provide potable water from 2 to 3 new groundwater wells in the Texas Springs Syncline. Alternative 3 would treat water collected for potable purposes using a reverse osmosis water treatment plant. Concentrate water generated from the water treatment process would be discharged to a percolation trench in Furnace Creek Wash for groundwater recharge. Nonpotable water would be provided from a rebuilt Furnace Creek Wash collection gallery as well as from the Inn Tunnel. Riparian water would be released from all of Travertine Springs and Texas Springs to restore historic wetland and riparian habitat. The restoration effort would include the incorporation of riparian water release measures that would reduce erosion and promote groundwater infiltration.

Under Alternative 3, maximum daily flow requirements would need to be met approximately 10% of a calendar year. The average daily flow requirements would need to be met 100% of the calendar year, and would constitute the water withdrawals from the Furnace Creek system approximately 90% of the year. To meet maximum daily flow requirements, Alternative 3 would collect approximately 600 gpm of potable water and 900 gpm of nonpotable water, and release approximately 770 gpm of riparian water. Approximately 120 gpm of concentrate water from the reverse osmosis water treatment plant would be discharged to a percolation trench for groundwater recharge (see table II-1 in Chapter II, Alternatives). To meet average daily flow requirements, Alternative 3 would collect approximately 429 gpm of potable water and 780 gpm of nonpotable water, and release approximately 770 gpm of riparian water. Approximately 86 gpm of concentrate water from the reverse osmosis water treatment plant would be discharged to a percolation trench for groundwater recharge (see table II-2 in Chapter II, Alternatives). Under average daily flow requirements, less potable water would be pumped from the proposed groundwater wells.

The exact effects of groundwater pumping are unknown at this time; however, discharges from the springs system would be expected to decline as the groundwater flow system reaches a new equilibrium. The overall reduction in flow from the springs system would be expected to be equal to the volume of groundwater pumped under the average daily demand scenario. The response to groundwater pumping would likely not occur immediately at the springs, as the National Park Service expects a time lag between the initiation of groundwater pumping and the effects observed at the springs and other discharge points. The length of the time lag could range from months to years and would depend upon the pumping rate and subsurface hydrogeologic conditions, which are not fully characterized. Full impacts of pumping may not be observed for 10 to 20 years after pumping begins. Due to the underlying hydrogeologic conditions of the area, it would be likely that the effects would be spread reasonably evenly throughout discharge points in the Furnace Creek area; however, there may be some variation in the effect at individual discharge points because of local differences in aquifer hydraulic properties and the distance of the discharge points from the groundwater pumping wells.

Despite the uncertainty regarding reduction in flow at any specific discharge point, the National Park Service believes that the hydrogeologic system in the Furnace Creek area is sufficiently homogenous that assumptions can be made regarding the effects of groundwater pumping on spring flow. Therefore, average daily flow requirements may decrease discharges from spring outlets. Based on an average water usage rate of 343 gpm of potable water (requiring 429 gpm of raw water with 100% supplied by groundwater wells) and computer modeling of the Texas Springs Syncline aquifer, the National Park Service estimates that discharges from spring outlets

may decrease an average of approximately 24% under Alternative 3 (NPS 2004c,d).[3] Flows from Travertine Springs Line 1, Line 2, Line 3, and Line 4 would be reduced to 103 gpm, 287 gpm, 37 gpm, and 191 gpm, respectively. Flows from Texas Spring would be reduced to 152 gpm.

Groundwater pumping from production wells in the Texas Springs Syncline would not be anticipated to reduce flows from the Inn Tunnel or Furnace Creek Wash collection systems by 24% as these systems draw upon groundwater flowing in the alluvium of Furnace Creek Wash. Groundwater availability in Furnace Creek Wash would be affected by a decrease in flow from the Travertine Springs due to groundwater pumping from the syncline; however, net groundwater flows in Furnace Creek Wash would be enhanced by increased riparian releases at Travertine Springs Lines 2, 3, and 4. In addition, reconstruction of the Furnace Creek Wash collection gallery would improve the water collection capabilities.

The increased groundwater pumping to meet maximum daily flow requirements (i.e., 600 gpm vs. 429 gpm from production wells) would not be expected to substantially affect discharge from the spring outlets due to the short-term and episodic nature of these well pumping requirements. A temporary reduction of spring discharge, based on pumping to meet maximum daily demand requirements, could be superimposed on the existing reduction caused by the average pumping rate; however, it is anticipated that the effects of maximum daily demand pumping would be dampened and attenuated by the time those stresses are observed in spring discharge. The National Park Service would select a pumping schedule that would minimize fluctuations in water levels (i.e. use a low pumping rate over a longer period of time rather than a high pumping rate over a shorter period of time) when feasible.

Alternative 4

Alternative 4 would provide water from Travertine Springs Lines 2, 3, and 4 and Texas Springs for potable use, and would treat water collected for potable purposes using a reverse osmosis water treatment plant. Concentrate water from the water treatment process would be discharged in a surface water release to a tributary of Texas Springs Wash utilizing water release control measures to reduce erosion and promote groundwater infiltration. Since the National Park Service would treat all potable water under this alternative (including bypass water), Travertine Springs Lines 2, 3, and 4 would not require reconstruction of spring collection boxes or clearing and grubbing of vegetation from the spring area. Nonpotable water would be provided from a rebuilt Furnace Creek Wash collection gallery as well as from the Inn Tunnel. Riparian water would be released from Travertine Springs Lines 1 and 2 and Texas Springs to partially restore historic wetland and riparian habitat. The restoration effort would include the incorporation of riparian water release measures that would reduce erosion and promote groundwater infiltration.

Similar to Alternatives 2 and 3, maximum daily flow requirements would need to be met approximately 10% of a calendar year. The average daily flow requirements would need to be met 100% of the calendar year, and would constitute the water withdrawals from the Furnace Creek system approximately 90% of the year. To meet maximum daily flow requirements, Alternative 4 would collect approximately 600 gpm of potable water and 900 gpm of nonpotable water, and discharge approximately 412 gpm of riparian water. Approximately 120 gpm of concentrate water from the reverse osmosis water treatment plant would be discharged as surface water releases to

[3] It is estimated that an average of 429 gpm would be pumped from the proposed groundwater wells under this alternative, which would be approximately 24% of total flow (i.e., 1,812 gpm) collected or discharged from the Furnace Creek system under the No Action Alternative.

augment flows in Texas Springs Wash (see table II-1 in Chapter II, Alternatives). To meet average daily flow requirements, Alternative 4 would collect approximately 429 gpm of potable water and 780 gpm of nonpotable water, and discharge approximately 583 gpm of riparian water. Approximately 86 gpm of concentrate water would be discharged as surface water releases to augment flows in Texas Springs Wash (see table II-2 in Chapter II, Alternatives). No groundwater would be pumped under Alternative 4.

Environmentally Preferable Alternative

The National Park Service considered the alternatives in this analysis in accordance with NEPA and Council on Environmental Quality regulations (Section 1505.2) and determined that Alternative 3 (Preferred) as presented in this environmental impact statement would be environmentally preferable based on its furtherance of the Section 101 NEPA goals. Alternative 3 would best fulfill the responsibilities of each generation as trustee of the environment for succeeding generations by having a major, beneficial impact on endemic invertebrate special-status species that exist in the Texas-Travertine Springs complex. Alternative 3 would discontinue water diversions from Travertine Springs Lines 2, 3, and 4 resulting in riparian releases to the aquatic environment below the collection galleries. Alternatives 2 and 4 would provide similar moderate, beneficial improvements to endemic invertebrate habitat; however, the habitat improvements under Alternatives 2 and 4 would not be at the same scale as under Alternative 3.

Alternative 3 would best meet the goal of providing all Americans with safe, healthful, productive, and aesthetically and culturally pleasing surroundings. Of the action alternatives, Alternative 3 would result in the most extensive restoration activities in the Texas-Travertine area because this alternative would release water from all four Travertine Springs and Texas Springs for riparian purposes.

Alternative 3 would attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences. All of the action alternatives would fulfill goal 3 by providing safe drinking water that would meet federal and state drinking water standards; however, Alternative 3 would be environmentally preferable due to proposed reestablishment of historic springs and wetlands in the Furnace Creek area. Alternative 3 would result in the most extensive riparian restoration effort at the Texas-Travertine Springs complex, and would have major, beneficial impacts to wetlands, vegetation, wildlife, and special-status species. Alternatives 2 and 4 would improve natural resources in the Furnace Creek area as well, but not to the same extent.

With respect to preserving important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice, all of the action alternatives could result in minor to moderate adverse impacts to cultural resources. The adverse impacts to cultural resources would be due to potential disturbance of such resources associated with ground-disturbing activities during construction, modifications to potentially historic sites, and ongoing maintenance of the water collection system. Alternative 1 would have negligible to minor, adverse impacts to cultural resources due to potential degradation of historic structures or archeological and cultural landscape resources associated with visitor use, routine maintenance and repairs, and natural processes. Alternative 3 would be environmentally preferable, however, due to proposed reestablishment of historic springs and wetlands in the Furnace Creek area. Alternative 3 would result in the most extensive

riparian restoration effort at the Texas-Travertine Springs complex. Alternatives 2 and 4 would improve natural resources in the Furnace Creek area as well, but not to the same extent. Alternative 1 would not include riparian restoration efforts.

Alternative 3 would achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities by developing a water collection system in Furnace Creek that would provide safe potable water to area users in quantities that meet legal water entitlements, while also providing the most extensive reestablishment of the historic riparian environment compared to the other alternatives.

Alternative 3 would enhance the quality of renewable resources by developing the most extensive array of alternative energy generation measures (e.g., solar and hydroelectric energy) in the Furnace Creek area compared to the other alternatives.

Table ES-1
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
GEOLOGIC RESOURCES			
Under Alternative 1, discharge of excess water from the 2-million gallon tank would be expected to exacerbate erosion in the project area over time. Alternative 1 would result in a local, long-term, minor, adverse impact.	Construction activities under Alternative 2 may result in short-term, negligible, adverse impacts associated with erosion from construction-related grading and trenching activities such as development of roads to access proposed groundwater production and monitoring wells. These impacts would be minimized by implementation of erosion control mitigation measures and the general absence of substantial precipitation throughout the year. Erosion associated with the spring releases for riparian purposes would be minimized through implementation of water release control measures designed to reduce erosion, resulting in an overall local, long-term, minor, beneficial impact. Over time riparian vegetation at the springs would reduce erosion associated with upslope runoff.	Construction activities under Alternative 3 may result in short-term, negligible, adverse impacts associated with erosion from construction-related grading and trenching activities such as development of roads to access proposed groundwater production and monitoring wells. These impacts would be minimized by implementation of erosion control mitigation measures and the general absence of substantial precipitation throughout the year. Erosion associated with the spring releases for riparian purposes would be minimized through implementation of water release control measures designed to reduce erosion, resulting in an overall local, long-term, moderate, beneficial impact. Over time riparian vegetation at the springs would reduce erosion associated with upslope runoff.	Construction activities under Alternative 4 may result in short-term, negligible, adverse impacts associated with erosion, associated with construction grading and trenching activities. These impacts would be minimized by implementation of erosion control mitigation measures and the general absence of substantial precipitation throughout the year. Erosion associated with the spring releases from Travertine Springs Lines 1 and 2 and Texas Springs for riparian purposes and surface water release of concentrate water from the reverse osmosis water treatment plant would be minimized through implementation of water release control measures designed to reduce erosion, resulting in an overall local, long-term, minor, beneficial impact. Over time riparian vegetation at the springs would reduce erosion associated with upslope runoff.
GEOLOGIC HAZARDS			
Under Alternative 1, the Furnace Creek water collection system would continue to be subject to potential adverse impacts associated with damage from future seismic events. Risk of earthquake damage, however, would not be substantially greater than existing conditions. Therefore, Alternative 1 would have a local, long-term, minor, adverse impact.	Alternative 2 would have a local, long-term, minor, beneficial impact with respect to seismic hazards. Should seismic activity occur, the proposed groundwater production wells would be less susceptible to disruption of water service due to alterations of subsurface fractures and faults than the spring collection systems under Alternative 1. In addition, the proposed facilities would be constructed to meet current building code standards, and would be less susceptible to damage in the event of an earthquake. This beneficial impact would offset the adverse effect associated with expanding the water conveyance system and increasing the linear feet of pipeline susceptible to seismic damage.	Alternative 3 would have a local, long-term, minor, beneficial impact with respect to seismic hazards. Should seismic activity occur, the proposed groundwater production wells would be less susceptible to disruption of water service due to alterations of subsurface fractures and faults than the spring collection systems under Alternative 1. In addition, the proposed facilities would be constructed to meet current building code standards, and would be less susceptible to damage in the event of an earthquake. This beneficial impact would offset the adverse effect associated with expanding the water conveyance system and increasing the linear feet of pipeline susceptible to seismic damage.	Alternative 4 would have a local, long-term, minor, beneficial impact with respect to seismic hazards. The proposed reverse osmosis water treatment plant would be constructed to meet current building code standards, and would be less susceptible to damage in the event of an earthquake. This beneficial impact would offset the adverse effect associated with expanding the water conveyance system and increasing the linear feet of pipeline susceptible to seismic damage.

Table ES-1 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
PALEONTOLOGICAL RESOURCES			
Alternative 1 would not alter the treatment of paleontological resources from their present condition. Degradation of paleontological resources such as fossils could occur due to visitor use, illicit collecting, routine maintenance and repairs, and natural processes. Local, long-term, minor, adverse impact under Alternative 1 would result from potential removal of fossils, damage to fossil beds, and loss of information.	Alternative 2 could result in local, long-term, moderate, adverse impacts to paleontological resources as a result of damage or destruction of fossils and fossil-bearing deposits during construction of pipelines, wells and associated roadways, and other construction-related activities. Degradation of paleontological resources also could occur due to ground-disturbing activities associated with ongoing maintenance and repair of the water system. Implementation of mitigation measures identified in Appendix D, Mitigation Measures Common to All Action Alternatives, including monitoring, identification, and development of appropriate treatment measures would result in a reduction of adverse impacts on paleontological resources from moderate to minor.	Alternative 3 could result in local, long-term, moderate, adverse impacts to paleontological resources as a result of damage or destruction of fossils and fossil-bearing deposits during construction of pipelines, wells and associated roadways, and other construction-related activities. Degradation of paleontological resources could occur due to ground-disturbing activities associated with ongoing maintenance and repair of the water system. Implementation of mitigation measures identified in Appendix D, Mitigation Measures Common to All Action Alternatives, including monitoring, identification, and development of appropriate treatment measures would result in a reduction of impacts to paleontological resources from moderate to minor.	Alternative 4 could result in local, long-term, moderate, adverse impacts to paleontological resources as a result of damage or destruction of fossils and fossil-bearing deposits during construction of pipelines, wells and associated roadways, the reverse osmosis water treatment plant, and other construction-related activities. Degradation of paleontological resources could occur due to ground-disturbing activities associated with ongoing maintenance and repair of the water system. Implementation of mitigation measures identified in Appendix D, Mitigation Measures Common to All Action Alternatives, including monitoring, identification, and development of appropriate treatment measures would result in a reduction of impacts to paleontological resources from moderate to minor.
HYDROLOGY			
Under Alternative 1, surface water resources in Furnace Creek would continue to be adversely affected by diversions associated with water collection activities, as all of Travertine Springs Lines 2, 3, and 4 would be used for water supply purposes. Existing water collection system components in Furnace Creek Wash also would continue to be subject to flooding, potentially necessitating repair by the National Park Service; however, these features would not affect flood flow dynamics. Groundwater would continue to be diverted from Furnace Creek Wash; however, the adverse effects to groundwater resource would be somewhat offset by the resource management and protection benefits	Under Alternative 2, groundwater pumping could result in a 7% decline of spring discharge rates in Texas Springs and Travertine Springs, and the springs complex between Travertine and Texas Springs due to the interconnected relation of surface water and groundwater at Furnace Creek. Although reduction of spring discharge rates would be an adverse impact, the restoration of spring discharge patterns at Travertine Springs Line 2 by releasing the entirety of spring flow for riparian purposes and initiation of concentrate water discharge from the reverse osmosis water treatment plant would result in a net, beneficial impact to surface water resources, as the net extent of stream channel lengths would increase. Groundwater pumping	Under Alternative 3, groundwater pumping would result in an approximate 24% decline of spring discharge rates in Texas Springs, Travertine Springs, and the springs between Travertine and Texas Springs due to the interconnected relation of surface water and groundwater at Furnace Creek. Although reduction of spring discharge rates would be an adverse impact, the restoration of spring discharge patterns at Travertine Springs Lines 2, 3, and 4 by releasing the entirety of spring flow for riparian purposes would result in a net, beneficial impact to surface water resources, as the net extent of stream channel lengths would increase. Groundwater pumping would adversely affect groundwater resources as groundwater levels in the	Under Alternative 4, surface water resources in Furnace Creek would continue to be adversely affected by diversions associated with water collection activities, as Travertine Springs Lines 3 and 4 would be used for water supply purposes. However, the ability of National Park Service to reduce diversions during non-peak demand periods would allow for nearly all of spring discharge at Travertine Springs Line 2 to be released for riparian purposes, thereby resulting in a net enhancement of stream channel length at Travertine Springs and in Furnace Creek Wash. Beneficial impacts associated with restoration of surface water flows and installation of four groundwater monitoring wells would outweigh adverse impacts on

Table ES-1 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
HYDROLOGY (continued)			
provided by the existing network of groundwater monitoring wells. Overall, Alternative 1 would result in a local, long-term, minor, adverse impact.	would adversely affect groundwater resources by lowering groundwater levels in the Texas Springs Syncline and capturing water which would otherwise discharge from springs in the Furnace Creek area. However, the ability of the aquifer to recharge would not be affected and the groundwater system would re-equilibrate over time such that water level drawdown and spring discharge would stabilize. Water collection, discharge, and conveyance facilities in Furnace Creek Wash and Furnace Creek Fan would continue to be potentially damaged by flood flows, necessitating potential repair by the National Park Service; however, the proposed water conveyance line/collection gallery in the wash and percolation trench/concentrate water conveyance line in the fan would be subsurface features that would not be as affected by flood flows. Therefore, Alternative 2 would result in a local, long-term, moderate, beneficial impact.	Texas Springs Syncline would be lowered, and water that would otherwise discharge from springs in the Furnace Creek area would be captured; however, recharge to the aquifer would not be affected and the system would re-equilibrate over time such that groundwater levels and spring discharge would stabilize. Water collection and conveyance facilities in Furnace Creek Wash would continue to be potentially damaged by flood flows, necessitating potential repair by the National Park Service; however, the proposed water conveyance line, collection gallery in the wash, and concentrate water percolation trench would be subsurface features that would not be as affected by flood flows. Therefore, Alternative 3 would result in a local, long-term, minor, beneficial impact.	groundwater resources, particularly as replacement of the antiquated water collection infrastructure would result in an overall minor, beneficial impact associated with restoration of natural flow patterns and water resources in the Furnace Creek area. Water collection and conveyance facilities in Furnace Creek Wash would continue to be potentially damaged by flood flows, necessitating potential repair by the National Park Service; however, the proposed water conveyance line and collection gallery in the wash would include subsurface features that would not be as affected by flood flows. Overall, Alternative 4 would result in a local, long-term, minor beneficial impact.
WATER QUALITY			
Under Alternative 1, drinking water supplies at Furnace Creek would continue to exceed regulatory standards for arsenic and fluoride concentrations, and would continue to be susceptible to coliform bacteria contamination. The inability to meet drinking water standards under Alternative 1 would result in an overall local, long-term, major, adverse impact.	Alternative 2 would have a local, long-term, moderate, beneficial impact due to providing potable water in the Furnace Creek area that would meet federal and state drinking water quality standards and recommendations by the California Department of Health Services. Although construction- and operation-related activities under Alternative 2 would result in negligible and minor, adverse water quality impacts, respectively, the beneficial effects on water quality associated with meeting regulatory standards would offset these adverse impact on surface water and groundwater quality.	Alternative 3 would have a local, long-term, moderate, beneficial impact due to providing potable water in the Furnace Creek area that would meet federal and state drinking water quality standards and recommendations by the California Department of Health Services. Although construction- and operation-related activities under Alternative 3 would result in negligible and minor, adverse water quality impacts, respectively, the beneficial effects on water quality associated with meeting regulatory standards would offset these adverse impacts to surface water and groundwater quality.	Alternative 4 would have a local, long-term, moderate, beneficial impact due to providing potable water in the Furnace Creek area that would meet federal and state drinking water quality standards and recommendations by the California Department of Health Services. Although construction- and operation-related activities under Alternative 4 would result in negligible and minor, adverse water quality impacts, respectively, the beneficial effects on water quality associated with meeting regulatory standards would offset these adverse surface water quality impacts.

Table ES-1 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
WETLANDS			
The Furnace Creek area contains a total of 12.243 acres of wetlands. Alternative 1 would continue to have a local, long-term, moderate, adverse effect on wetlands in the project area due to the limited size, quality, and connectivity of jurisdictional wetlands and Cowardin wetlands (palustrine forest, palustrine scrub-shrub, palustrine emergent, and riverine). Such effects would include compromised hydrologic connectivity, non-native species invasion, and reduced or lack of water.	Construction activities would affect a total of approximately 0.010 acres of wetlands, including palustrine emergent and riverine intermittent streambed due to installing culverts, a collection gallery, and nonpotable pipeline for connection at the Inn Tunnel. Alternative 2 would result in an approximately 98% increase in riparian water discharged from springs (under average and maximum daily flow requirements, incorporating potential reductions [7%] in spring flow from groundwater pumping) due to groundwater pumping in two groundwater wells and associated potable average water demands, primarily to wetlands at Travertine Springs Line 2. Groundwater pumping effects would reduce the extent of existing wetlands by approximately one acre; however, it is anticipated that approximately 38 acres of palustrine and riverine wetland habitat would be restored. Discharge of concentrate water would not result in effects to wetlands. With implementation of Best Management Practices and mitigation measures, the intensity of construction impacts to wetlands would be reduced to minor. Overall, Alternative 2 would have a local, long-term, moderate, beneficial impact on wetlands. The beneficial effects associated with allowing natural re-establishment of springs as a result of partial discontinuation of water diversion activities under this alternative and re-establishing riparian habitat in Furnace Creek Wash would outweigh the adverse construction-related impacts.	Construction activities would affect a cumulative total of approximately 0.013 acre of wetlands, including palustrine emergent and riverine intermittent streambed due to installing culverts and a Furnace Creek Wash collection gallery. Impacts may include erosion in streams, permanent disturbance to palustrine emergent wetlands, and temporary disturbance such as trampling to palustrine and riverine wetlands. Alternative 3 would result in an approximately 130% increase in riparian water discharged from the springs (under average and maximum daily flow requirements, incorporating potential reductions [24%] in spring flow from groundwater pumping). Groundwater pumping effects would potentially reduce the linear extent and size of wetlands by approximately 3 acres; however, it is anticipated that approximately 60 acres of palustrine and riverine wetland habitat would be restored. Discharge of concentrate water for groundwater recharge would not result in effects to wetlands. With implementation of Best Management Practices and mitigation measures (see Appendix D), the intensity of construction impacts to wetlands would be minor. Overall, Alternative 3 would have a local, long-term, major, beneficial impact on wetlands. The beneficial effects of discontinuing water diversions at Travertine Springs and Texas Springs under this alternative and re-establishing riparian habitat in Furnace Creek Wash would outweigh the adverse construction-related impacts.	Construction activities would affect a total of approximately 0.010 acres of wetlands, including palustrine emergent and riverine intermittent streambed due to installing culverts, a collection gallery, and a nonpotable pipeline. Alternative 4 would result in a 74% increase in riparian discharges from springs during average daily flow requirements, and would release slightly more water (412 gpm) for riparian use than Alternative 1 (335 gpm) during maximum daily flow requirements. It is anticipated that Alternative 4 would restore approximately 35 acres of palustrine and riverine wetlands in the Furnace Creek area. Discharge of concentrate water could slightly limit the extent and diversity of native wetland vegetation in the receiving water drainage. Implementation of Best Management Practices and mitigation measures, (including utilization of wetland protection and compensation measures), would reduce the intensity of construction impacts to wetlands to minor. Overall, Alternative 4 would have a local, long-term, moderate, beneficial impact on wetlands. The beneficial effects associated with shifting discharges from the disturbed wetland system at Texas Springs to Travertine Springs Line 2, where re-establishment of wetlands would increase the size of wetlands in the Travertine Springs system, and re-establishing riparian habitat in Furnace Creek Wash would outweigh the adverse construction-related impacts.

Table ES-1 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
VEGETATION			
Alternative 1 would provide a limited comprehensive approach to improvements and management of natural plant communities. The size and continuity of riparian communities and the loss of natural drainage patterns would remain reduced because of water diversion activities. The size, continuity and quality of vegetation would continue to degrade due to the spread of non-native species. Effects on vegetation within the project area would result in a local, long-term, moderate, adverse impact.	Although the size of plant communities would be minimally reduced and vegetation trampling effects could occur during construction, discontinuation of water diversions at Travertine Springs Line 2 and implementation of the riparian water release standards would moderately improve vegetation in the long-term by increasing the size, quality, and continuity of wetland and upland vegetation, improving plant community dynamics, and enhancing species diversity within the project area. The effects of concentrate water discharge from the reverse osmosis water treatment plant for groundwater recharge and increased riparian releases from Travertine Springs Line 2 would result in a negligible, beneficial impact on vegetation due to augmentation of water supply to the mesquite bosque. Implementation of Best Management Practices and mitigation measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce construction-related effects to minor, and operation-related adverse effects (including encouraging the spread of invasive, non-native species in wetland areas) to minor. Overall, Alternative 2 would have a local, long-term, moderate, beneficial impact on vegetation. The beneficial effects associated with re-establishing historic springs and restoring wetland and upland vegetation in the Furnace Creek area would contribute appreciably and outweigh the adverse construction- and operation-related impacts.	The size of plant communities would be minimally reduced and vegetation trampling effects could occur during construction; however, increased flows from all lines of the Travertine Springs and Texas Springs systems for riparian allocation and implementation of the riparian release standards would improve vegetation in the long-term by greatly increasing the size, quality, and continuity of vegetation, improving plant community dynamics, and enhancing species diversity within the project area. The effects of concentrate water discharge from the reverse osmosis water treatment plant would result in a negligible, beneficial impact on vegetation due to augmentation of water supply to the mesquite bosque associated with concentrate water discharge and increased riparian releases from Travertine Springs. Implementation of best management practices and mitigation measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce construction-related effects to minor, and operation-related adverse effects (including encouraging the spread of invasive, non-native species) would be reduced to minor. Overall, Alternative 3 would have a local, long-term, major, beneficial impact on vegetation. The beneficial effects associated with re-establishing historic springs and wetland vegetation at Travertine Springs and Texas Springs systems would outweigh the adverse construction- and operation-related impacts.	The size of plant communities would be minimally reduced and vegetation trampling effects could occur during construction; however, discharges from springs under Alternative 4 and implementation of the riparian release standards would improve vegetation in the long-term by moderately increasing the size, quality and continuity of wetland vegetation, improving plant community dynamics and enhancing species diversity within the project area. Implementation of best management practices and mitigation measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce adverse construction-related effects to minor, and adverse operation-related effects (including encouraging the spread of invasive, nonnative species) to minor. Overall, Alternative 4 would have a local, long-term, moderate, beneficial impact on vegetation. The beneficial effects associated with re-establishing historic springs and wetland vegetation in Furnace Creek area would outweigh the adverse construction-related impacts.

Table ES-1 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
WILDLIFE			
Under Alternative 1, the maintenance of the current levels and locations of surface water diversions would continue to adversely affect wildlife habitat in the Furnace Creek area. The already degraded conditions of aquatic and riparian wildlife resources within the project area would likely persist. Therefore, Alternative 1 would have local, long-term, moderate, adverse impacts on wildlife.	Construction-related activities would have a minor to moderate adverse effect on wildlife through habitat disturbance, noise, human presence, and operation of heavy equipment. Implementation of Best Management Practices and mitigation measures such as preconstruction wildlife surveys and erosion and sedimentation control measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce the magnitude of the adverse effects on wildlife to minor. Overall, Alternative 2 would have a local, long-term, moderate, beneficial effect on wildlife due to an increase in riparian discharges, and concomitant increases in aquatic and riparian habitat availability, in the Furnace Creek area. The beneficial effects associated with the reestablishment of wildlife habitat at Travertine Springs Line 2, and the extension of such habitat in the Furnace Creek Wash due to the relocation of the collection gallery, would outweigh the adverse construction-related and groundwater pumping-related impacts, as well as the impacts of eliminating groundwater recharge at the Inn Tunnel and slightly reducing discharges at the spring complex located between Travertine and Texas Springs. Alternative 2 would have local, long-term, moderate, beneficial impact on wildlife.	Construction-related activities would have a minor to moderate adverse effect on wildlife through habitat disturbance, noise, human presence, and operation of heavy equipment. Implementation of Best Management Practices and mitigation measures such as preconstruction wildlife surveys and erosion and sedimentation control measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce the magnitude of the adverse effects on wildlife to minor. Overall, Alternative 3 would have a local, long-term, major, beneficial effect on wildlife due to an overall increase in riparian discharges, and concomitant increases in aquatic and riparian habitat availability, in the Furnace Creek area. The beneficial effects associated with the reestablishment of wildlife habitat at Travertine Springs Lines 2, 3, and 4, and the extension of such habitat in the Furnace Creek Wash due to the relocation of the collection gallery, would outweigh the adverse construction-related effects, potential groundwater pumping-related and erosional impacts, and the effects of eliminating groundwater recharge at the Inn Tunnel associated with this alternative. Alternative 3 would have local, long-term, major, beneficial impact on wildlife.	Construction-related activities would have a minor to moderate adverse effect on wildlife through habitat disturbance, noise, human presence, and operation of heavy equipment. Implementation of Best Management Practices and mitigation measures such as preconstruction wildlife surveys and erosion and sedimentation control measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce the magnitude of the adverse effects on wildlife to minor. Overall, Alternative 4 would have a local, long-term, moderate, beneficial effect on wildlife due to the overall shift of riparian discharges from disturbed habitat at Texas Springs and the percolation trench at the Inn Tunnel to historic spring channels at Travertine Springs Line 2, where the potential for successful restoration of historic wildlife habitat appears to be high. Furthermore, the downstream relocation of the Furnace Creek Wash gallery would result in an increase in wildlife habitat at that location. The beneficial effects associated with the re-establishment of wildlife habitat at Travertine Springs Line 2 and the extension of such habitat in the Furnace Creek Wash would outweigh the adverse construction-related impacts and loss of groundwater recharge at the Inn Tunnel and riparian discharges at Texas Springs associated with this alternative. Alternative 4 would have local, long-term, moderate, beneficial impact on wildlife.

Table ES-1 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
SPECIAL-STATUS SPECIES			
Under Alternative 1, the maintenance of the current levels and locations of surface water diversions would continue to adversely affect special-status species and their habitat in the Furnace Creek area. The already degraded conditions of aquatic and riparian habitats within the project area would likely persist. Alternative 1 would have local, long-term, moderate to major, adverse impacts on special-status species. The existing adverse impacts to special- status invertebrates would be expected to persist. The future extinction of one or more endemic invertebrate species would be a distinct possibility under Alternative 1.	Construction-related activities would have a minor to moderate adverse effect on special-status species through habitat disturbance (including trampling), noise, human presence, and operation of heavy equipment. Implementation of Best Management Practices and mitigation measures such as preconstruction surveys, maintenance of routes of escape from excavated pits and trenches for animals that might fall in, and avoidance of special-status plant species (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce the magnitude of the adverse effects on special-status species to minor. Overall, Alternative 2 would have a local, long-term, moderate, beneficial effect on special-status species due to an overall increase in riparian discharges, and concomitant increases in aquatic and riparian habitat availability, in the Furnace Creek area. The beneficial effects associated with the reestablishment of wetland and riparian habitat at Travertine Springs Line 2, and the extension of such habitat in the Furnace Creek Wash due to the relocation of the collection gallery, would outweigh the adverse construction-related and groundwater pumping-related impacts, the impacts of eliminating groundwater recharge from the Inn Tunnel, and the potential effects of erosion at riparian discharge locations. Alternative 2 would have local, long-term, moderate, beneficial impact on special-status species.	Construction-related activities would have a minor to moderate adverse effect on special-status species through habitat disturbance (including trampling), noise, human presence, and operation of heavy equipment. Implementation of Best Management Practices and mitigation measures such as preconstruction surveys, maintenance of routes of escape from excavated pits and trenches for animals that might fall in, and avoidance of special-status plant species (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce the magnitude of the adverse effects on special-status species to minor. Overall, Alternative 3 would have a local, long-term, major, beneficial effect on special-status species due to a substantial increase in riparian discharges, and concomitant increases in aquatic and riparian habitat availability, in the Furnace Creek area. The beneficial effects associated with the reestablishment of wetland and riparian habitat at Travertine Springs Lines 2, 3, and 4, and the extension of such habitat in the Furnace Creek Wash area due to the relocation of the collection gallery, would outweigh the adverse construction-related and groundwater pumping-related impacts, the effects of eliminating groundwater recharge at the Inn Tunnel and reducing discharges at the spring complex located between Travertine and Texas Springs, and the potential effects of erosion at the spring discharge locations. Alternative 3 would have local, long-term, major, beneficial impact on special-status species.	Construction-related activities would have a minor to moderate adverse effect on special-status species through habitat disturbance (including trampling), noise, human presence, and operation of heavy equipment. Implementation of Best Management Practices and mitigation measures such as preconstruction surveys, maintenance of routes of escape from excavated pits and trenches for animals that might fall in, and avoidance of special-status plant species (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce the magnitude of the adverse effects on special-status species to minor. Overall, Alternative 4 would have a local, long-term, moderate, beneficial effect on special-status species due to an overall increase in riparian discharges, and concomitant increases in aquatic and riparian habitat availability, in the Furnace Creek area. The beneficial effects associated with the reestablishment of wetland and riparian habitat at Travertine Springs Line 2 and the extension of such habitat in the Furnace Creek Wash due to the relocation of the collection gallery, would outweigh the adverse construction-related impacts, as well as the impacts of eliminating groundwater recharge at the Inn Tunnel, reducing riparian discharges at Texas Springs, and the potential effects of erosion at riparian discharge locations. Alternative 4 would have local, long-term, moderate, beneficial impact on special-status species.

Table ES-1 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
AIR QUALITY			
Under Alternative 1, there would be no additional increase or decrease to air quality compared to current conditions, and no impact would occur.	Alternative 2 would have a local, long-term, negligible, adverse effect on air quality. With mitigation measures, the effect of air pollutant emissions associated with construction activities at the project site under Alternative 2 would be negligible due to the intensity of construction and the distance between the construction sites and sensitive receptors. Groundwater production wells and the reverse osmosis water treatment plant constructed under Alternative 2 would be electrically powered and minimal new traffic would be associated with ongoing operation of the proposed water system resulting in negligible, adverse effects to the air quality in the Furnace Creek area.	Alternative 3 would have a local, long-term, negligible, adverse effect on air quality. With mitigation measures, the effect of air pollutant emissions associated with construction activities at the project site under Alternative 3 would be negligible due to the intensity of construction and the distance between the construction sites and sensitive receptors. Groundwater production wells and the reverse osmosis water treatment plant constructed under Alternative 3 would be electrically powered and minimal new traffic would be associated with ongoing operation of the proposed water system resulting in negligible, adverse effects to the air quality in the Furnace Creek area.	Alternative 4 would have a local, long-term, negligible, adverse effect on air quality. With mitigation measures, the effect of air pollutant emissions associated with construction activities at the project site under Alternative 4 would be negligible due to the intensity of construction and the distance between the construction sites and sensitive receptors. The reverse osmosis water treatment plant constructed under Alternative 4 would be electrically powered and minimal new traffic would be associated with ongoing operation of the proposed water system resulting in negligible, adverse effects to the air quality in the Furnace Creek area.
SOUNDSCAPES			
Under Alternative 1, there would be no additional increase or decrease to noise levels compared to current conditions.	Alternative 2 would have a local, short-term, minor, adverse effect on the ambient soundscape environment associated with construction-related noise. Operation of the water collection system under Alternative 2 would result in a local, long-term, negligible, adverse impact. The two groundwater production wells, reverse osmosis water treatment plant, hydroelectric turbine, and minimal new traffic associated with ongoing operation of the proposed water system would result in negligible adverse effects to the ambient soundscape environment in the Furnace Creek area that would not be of any measurable or perceptible consequence to the visitor experience.	Alternative 3 would have a local, short-term, minor, adverse effect on the ambient soundscape environment associated with construction-related noise. Operation of the water system under Alternative 3 would result in a local, long-term, negligible, adverse impact. The two to three groundwater production wells, reverse osmosis water treatment plant, hydroelectric turbine, and minimal new traffic associated with ongoing operation of the proposed water system would result in negligible, adverse effects to the ambient soundscape environment in the Furnace Creek area that would not be of any measurable or perceptible consequence to the visitor experience.	Alternative 4 would have a local, short-term, minor, adverse effect on the ambient soundscape environment associated with construction-related noise. Operation of the water system under Alternative 4 would result in a local, long-term, negligible, adverse impact. The reverse osmosis water treatment plant, hydroelectric turbine, and minimal new traffic associated with ongoing operation of the proposed water system would result in negligible, adverse effects to the ambient soundscape environment in the Furnace Creek area that would not be of any measurable or perceptible consequence to the visitor experience.

Table ES-1 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
CULTURAL RESOURCES *ARCHEOLOGICAL RESOURCES*			
Localized, negligible to minor impacts to archeological resources would continue due to visitor use, routine maintenance and repairs, and natural processes. Because there would be no new ground disturbance, impacts to archeological resources would be local, long-term, negligible to minor, and adverse.	Construction activities and long-term operational activities under the implementation of Alternative 2 could result in local, long-term, minor to moderate, adverse impacts to archeological resources. In the event adverse impacts to National Register eligible archeological resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Construction activities and long-term operational activities associated with the implementation of Alternative 3 could result in local, long-term, minor to moderate, adverse impacts to archeological resources. In the event adverse impacts to National Register eligible archeological resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Construction activities and long-term operational activities under the implementation of Alternative 4 could result in local, long-term, minor to moderate, adverse impacts to archeological resources. In the event adverse impacts to National Register eligible archeological resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.
HISTORIC STRUCTURES			
Visitor use, routine maintenance and repairs, and natural weathering processes would continue to have a local, negligible to minor impact on historic structures. Alternative 1 would have local, long-term, negligible to minor, adverse impacts to historic structures.	Construction activities and long-term operational activities under the implementation of Alternative 2 could result in local, long-term, minor to moderate, adverse impacts to historic structures. In the event adverse impacts to National Register eligible historic structures could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Construction activities and long-term operational activities associated with the implementation of Alternative 3 could result in local, long-term, minor to moderate, adverse impacts to historic structures. In the event adverse impacts to National Register eligible historic structures could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Construction activities and long-term operational activities associated with the implementation of Alternative 4 could result in local, long-term, minor to moderate, adverse impacts to historic structures. In the event adverse impacts to National Register eligible historic structures could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.
ETHNOGRAPHIC RESOURCES			
On-going impacts to the mesquite bosque would continue resulting in local, long-term, moderate, adverse impacts to ethnographic resources.	Alternative 2 could have a local, long-term, minor to moderate, adverse impact on ethnographic resources due to potential disturbance of such resources during construction-related activities, including changes in setting. The release of water for riparian restoration and concentrate water for groundwater recharge would beneficially affect the mesquite bosque. In the event adverse impacts to National Register eligible ethnographic resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Alternative 3 could have a local, long-term, minor to moderate, adverse impact on ethnographic resources due to potential disturbance of such resources during construction-related activities including changes in setting. The release of water for riparian restoration and concentrate water for groundwater recharge would beneficially effect the mesquite bosque. In the event adverse impacts to National Register eligible ethnographic resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Alternative 4 could have a local, long-term, minor to moderate, adverse impact on ethnographic resources due to potential disturbance of such resources during construction-related activities, including changes in setting. The release of water for riparian restoration and concentrate water for groundwater recharge would beneficially affect the mesquite bosque. In the event adverse impacts to National Register eligible ethnographic resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.

Table ES-1 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
		CULTURAL LANDSCAPE RESOURCES	
Negligible to minor degradation due to visitor use, routine maintenance and repairs, and natural processes would continue. There would be no actions undertaken under Alternative 1 that would result in any new impacts to cultural landscapes, therefore implementation of Alternative 1 would result in continued local, long-term, negligible to minor, adverse impacts to cultural landscapes.	Construction activities and long-term operational activities associated with the implementation of Alternative 2 could result in local, long-term, minor to moderate, adverse impacts to cultural landscape resources. In the event adverse impacts to National Register eligible cultural landscape resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Construction activities and long-term operational activities associated with the implementation of Alternative 3 could result in local, long-term, minor to moderate, adverse impacts to cultural landscape resources. In the event adverse impacts to National Register eligible cultural landscape resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Construction activities and long-term operational activities associated with the implementation of Alternative 4 could result in local, long-term, minor to moderate, adverse impacts to cultural landscape resources. In the event adverse impacts to National Register eligible cultural landscape resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts identified in Appendix D, Mitigation Measures Common to All Action Alternatives, including implementation of the stipulations of the PA executed in compliance with Section 106 of the NHPA, would result in identification of cultural landscape resources and in mitigation of any adverse impacts to cultural landscape resources as a result of construction and operation-related activities, reducing impacts from major to moderate.
		VISITOR EXPERIENCE	
The continued unreliability of the Furnace Creek water system supply and quality and ongoing erosion at Texas Springs would detract from the use of recreational resources in the Furnace Creek area and would have a local, long-term, minor, adverse impact on recreation resources in the Furnace Creek area. Orientation and interpretation services and opportunities would continue to be available through the Furnace Creek Visitor Center and other park resources. Alternative 1 would have no impact on orientation and operation resources in the Furnace Creek area. The continued unreliability of the Furnace Creek water system supply and quality would detract from the use of visitor facilities in the Furnace Creek area and would have a local, long-term, minor, adverse impact on	Under Alternative 2, construction activities would disrupt use of and access to recreation opportunities in the project area and adjacent areas resulting in a local, short-term, minor, adverse impact in the project area compared to Alternative 1. Overall, Alternative 2 would result in a local, long-term, minor, beneficial impact compared to Alternative 1, due to improved water supply reliability and quality to recreation areas and improved sightseeing opportunities related to riparian and mesquite bosque restoration. Facility construction under Alternative 2 would disrupt orientation and interpretation opportunities in the project area resulting in a local, short-term, minor, adverse impact to orientation and interpretation compared to Alternative 1.	Under Alternative 3, construction activities would disrupt use of and access to recreation opportunities in the project area and adjacent areas resulting in a local, short-term, minor, adverse impact in the project area compared to Alternative 1. Overall, Alternative 3 would result in a local, long-term, minor, beneficial impact compared to Alternative 1, due to improved water supply reliability and quality to recreation areas and improved sightseeing opportunities related to riparian restoration. Facility construction under Alternative 3 would disrupt orientation and interpretation opportunities in the project area resulting in a local, short-term, minor, adverse impact to orientation and interpretation compared to Alternative 1. Orientation and interpretation services	Under Alternative 4, construction activities would disrupt use of and access to recreation opportunities in the project area and adjacent areas resulting in a local, short-term, minor, adverse impact in the project area compared to Alternative 1. Overall, Alternative 4 would result in a local, long-term, minor, beneficial impact compared to Alternative 1, due to improved water supply reliability and quality to recreation areas and improved sightseeing opportunities related to riparian restoration. Facility construction under Alternative 4 would disrupt orientation and interpretation opportunities in the project area resulting in a local, short-term, minor, adverse impact to orientation and interpretation compared to Alternative 1.

Table ES-1 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
VISITOR EXPERIENCE (continued)			
visitor services in the Furnace Creek area. Under Alternative 1, existing facilities would not be readily apparent from Wilderness areas and visitors to those areas would continue to experience solitude, natural quiet, and backcountry scenery. Alternative 1 would have no impact on Wilderness experience in the Furnace Creek area and vicinity.	Orientation and interpretation services and opportunities would continue to be available through the Furnace Creek Visitor Center and other park resources. Alternative 2 would have no operation-related impacts on orientation and interpretation resources in the Furnace Creek area. Under Alternative 2, construction activities would disrupt use of existing visitor-service facilities resulting in a local, short-term, minor, adverse impact to visitor services compared to Alternative 1. Overall, operation of park visitor service facilities under Alternative 2 would include a reliable water supply that meets State water quality requirements and would result in an overall local, long-term, minor, beneficial impact compared to Alternative 1.Construction activities under Alternative 2 would include activities at the Texas Springs Syncline that are near Wilderness areas and could result in disruption to use and enjoyment of Wilderness areas by temporarily reducing the solitude, natural quiet, and backcountry scenery of Wilderness areas, resulting in a local, short-term, minor, adverse impact on the Wilderness experience in the Furnace Creek area compared to Alternative 1. Following the restoration of construction areas, most water supply facilities would be below ground or at-grade and would not be readily apparent from Wilderness areas. Therefore, operation under Alternative 2 would have a local, long-term, negligible, adverse impact on the Wilderness experience in the Furnace Creek area compared to Alternative 1.	and opportunities would continue to be available through the Furnace Creek Visitor Center and other park resources. Alternative 3 would have no operation-related impacts on orientation and interpretation resources in the Furnace Creek area. Under Alternative 3, construction activities would disrupt use of existing visitor-service facilities resulting in a local, short-term, minor, adverse impact to visitor services compared to Alternative 1. Operation of park visitor service facilities under Alternative 3 would include a reliable water supply that meets State water quality requirements and would result in an overall local, long-term, minor, beneficial impact compared to Alternative 1. Construction activities under Alternative 3 would include activities at the Texas Springs Syncline area that are near Wilderness areas and could result in disruption to use and enjoyment of Wilderness areas by temporarily reducing the solitude, natural quiet, and backcountry scenery of Wilderness areas, resulting in a local, short-term, minor, adverse impact on the Wilderness experience in the Furnace Creek area compared to Alternative 1. Following construction and restoration of construction areas, most water supply facilities would be below ground or at-grade and would not be readily apparent from Wilderness areas. Therefore, operation under Alternative 3 would have a local, long-term, negligible, adverse impact on the Wilderness experience in the Furnace Creek area compared to Alternative 1.	Orientation and interpretation services and opportunities would continue to be available through the Furnace Creek Visitor Center and other park resources. Alternative 4 would have no operation-related impacts on orientation and interpretation resources in the Furnace Creek area. Under Alternative 4, construction activities would disrupt use of existing visitor-service facilities resulting in a local, short-term, minor, adverse impact to visitor services compared to Alternative 1. Operation of park visitor service facilities under Alternative 4 would include a reliable water supply that meets State water quality requirements and would result in an overall local, long-term, minor, beneficial impact compared to Alternative 1.Construction activities under Alternative 4 would include activities located approximately one mile from Wilderness areas. These activities may be somewhat apparent from Wilderness areas, temporarily reducing the solitude, natural quiet, and backcountry scenery of Wilderness areas, resulting in a local, short-term, negligible to minor, adverse impact on the Wilderness experience in the Furnace Creek area compared to Alternative 1. Following restoration of construction areas, water supply facilities in this area would not be readily apparent from Wilderness areas. Therefore, operation under Alternative 4 would have a local, long-term, negligible, adverse impact on the Wilderness experience in the Furnace Creek area compared to Alternative 1.

Table ES-1 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
TRANSPORTATION			
Continuation of the current management activities related to the water collection system would cause local, long-term, moderate, adverse impacts to traffic safety and roadway structural conditions.	Alternative 2 would have a local, long-term, moderate, beneficial impact on traffic safety and roadway structural conditions. Implementation of Best Management Practices and mitigation measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce construction-related effects to negligible. Overall, Alternative 2 would have a local, long-term, moderate, beneficial impact on traffic safety and roadway structural conditions.	Alternative 3 would have a local, long-term, moderate, beneficial impact on traffic safety and roadway structural conditions. Implementation of Best Management Practices and mitigation measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce construction-related effects to negligible. Overall, Alternative 3 would have a local, long-term, moderate, beneficial impact on traffic safety and roadway structural conditions.	Alternative 4 would have a local, long-term, moderate, beneficial impact on traffic safety and roadway structural conditions. Implementation of Best Management Practices and mitigation measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce construction-related effects to negligible. Overall, Alternative 4 would have a local, long-term, moderate, beneficial impact on traffic safety and roadway structural conditions.
SCENIC RESOURCES			
The continued presence of built features in the natural environment at Furnace Creek and ongoing erosion at Texas Springs would detract from the visual character of the area and would have a local, long-term, minor, adverse impact on scenic resources in the Furnace Creek area.	The construction effort for Alternative 2 would have local, short-term, moderate, adverse impacts to scenic resources. Adverse construction-related impacts would be associated with clearly visible demolition and construction activities that would detract from the visual setting of the Furnace Creek area. Alternative 2 would have a local, long-term, minor, beneficial impact on scenic resources compared to Alternative 1. The beneficial effects associated with the proposed riparian restoration activities and the reestablishment of historic wetland and riparian areas at Travertine Springs Lines 1 and 2 and Texas Springs would offset the adverse effects to scenic resources associated with the increased developed features (such as the proposed reverse osmosis water treatment plant, two groundwater wells and associated pump houses, and monitoring wells) at the project site.	The construction effort for Alternative 3 would have local, short-term, moderate, adverse impacts to scenic resources. Adverse construction-related impacts would be associated with clearly visible demolition and construction activities that would detract from the visual setting of the Furnace Creek area. Alternative 3 would have a local, long-term, minor, beneficial impact on scenic resources compared to Alternative 1. The beneficial effects associated with the proposed riparian restoration activities and the reestablishment of historic wetland and riparian areas at all four Travertine Springs and Texas Springs would offset the adverse effects to scenic resources associated with the increased developed features (such as the proposed reverse osmosis water treatment plant, two to three groundwater wells and associated pump houses, and monitoring wells) at the project site.	The construction effort for Alternative 4 would have local, short-term, minor, adverse impacts to scenic resources. Adverse construction-related impacts would be associated with clearly visible demolition and construction activities that would detract from the visual setting of the Furnace Creek area. Alternative 4 would have a local, long-term, minor beneficial impact on scenic resources compared to Alternative 1. The beneficial effects associated with the proposed riparian restoration activities and the reestablishment of historic wetland and riparian areas at Travertine Springs Lines 1 and 2 and Texas Springs (based on partial and not total release of riparian water from Texas Springs and Travertine Springs Line 2) would offset the adverse effects to scenic resources associated with the increased developed features (such as the proposed reverse osmosis water treatment plant and monitoring wells) at the project site.

Table ES-1 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
SOCIOECONOMICS			
Alternative 1 would have a local, short-term, moderate, adverse operation-related impact on the local economy and community associated with potential water service failures or deficiencies. Similarly, Alternative 1 would have a regional, short-term, negligible to minor, adverse operation-related impact on the regional economy associated with potential water service failures or deficiencies. The impacts would be short-term due to the temporary nature of a potential water service failure or system deficiency.	Alternative 2 would have a local, long-term, minor, beneficial effect on the socioeconomic environment due to the beneficial effect of the improved water security system on the character of the social and economic environments. Proposed short-term construction and long-term operation and maintenance spending associated with Alternative 2 would total $2.5 million for construction and approximately $2.1 million for operation and maintenance of the proposed water system. Proposed construction and operation and maintenance spending would have a regional, long-term, negligible, beneficial impact on the regional economy. The magnitude of the proposed spending would not be expected to have a discernable effect on the regional economy.	Similar to Alternative 2, Alternative 3 would have a local, long-term, minor, beneficial effect on the socioeconomic environment due to the beneficial effect of the improved water security system on the character of the social and economic environments. Proposed short-term construction and long-term operation and maintenance spending associated with Alternative 3 would total $2.5 million for construction and approximately $2.2 million for operation and maintenance of the proposed water system. Proposed construction and operation and maintenance spending would have a regional, long-term, negligible, beneficial impact on the regional economy. The magnitude of the proposed spending would not be expected to have a discernable effect on the regional economy.	Similar to Alternative 2, Alternative 4 would have a local, long-term, minor, beneficial effect on the socioeconomic environment due to the beneficial effect of the improved water security system on the character of the social and economic environments. Proposed short-term construction and long-term operation and maintenance spending associated with Alternative 4 would total $2.0 million for construction and approximately $1.7 million for operation and maintenance of the proposed water system. Proposed construction and operation and maintenance spending would have a regional, long-term, negligible, beneficial impact on the regional economy. The magnitude of the proposed spending would not be expected to have a discernable effect on the regional economy.
PARK OPERATIONS AND FACILITIES			
The aging water system infrastructure at Furnace Creek would continue to be substandard in terms of reliability and water quality. These problems would be expected to increase over time as the system continues to deteriorate. Erosion from water releases from Texas Springs and the 2-million gallon tank would continue to adversely affect the effectiveness of resources management. Together, these conditions would result in a local, long-term, moderate, adverse effect on park operations.	Overall, Alternative 2 would have a local, long-term, moderate, beneficial impact on park operations and facilities due principally to water system infrastructure improvements as well as improvements in resources management associated with riparian releases. Alternative 2 would enable park operations staff to improve the quality and effectiveness of park infrastructure and, by reliably providing a water supply that meets applicable standards, better provide for a positive visitor experience.	Alternative 3 would have a local, long-term, moderate, beneficial impact on park operations and facilities due principally to water system infrastructure improvements as well as improvements in resources management associated with riparian releases. Similar to Alternative 2, Alternative 3 would enable park operations staff to improve the quality and effectiveness of park infrastructure and, by reliably providing a water supply that meets applicable state and federal standards, better provide for a positive visitor experience.	Alternative 4 would have a local, long-term, moderate, beneficial impact on park operations and facilities due to water system infrastructure improvements. Alternative 4 would enable park operations staff to improve the quality and effectiveness of park water system infrastructure in order to reliably provide a water supply that meets applicable state and federal standards.

Chapter I: Purpose and Need

Scenery on Furnace Creek Ranch, 1905. Photo by Clarence J. Back, courtesy Death Valley National Park, catalog number DEVA 46012.

Chapter I: Purpose and Need

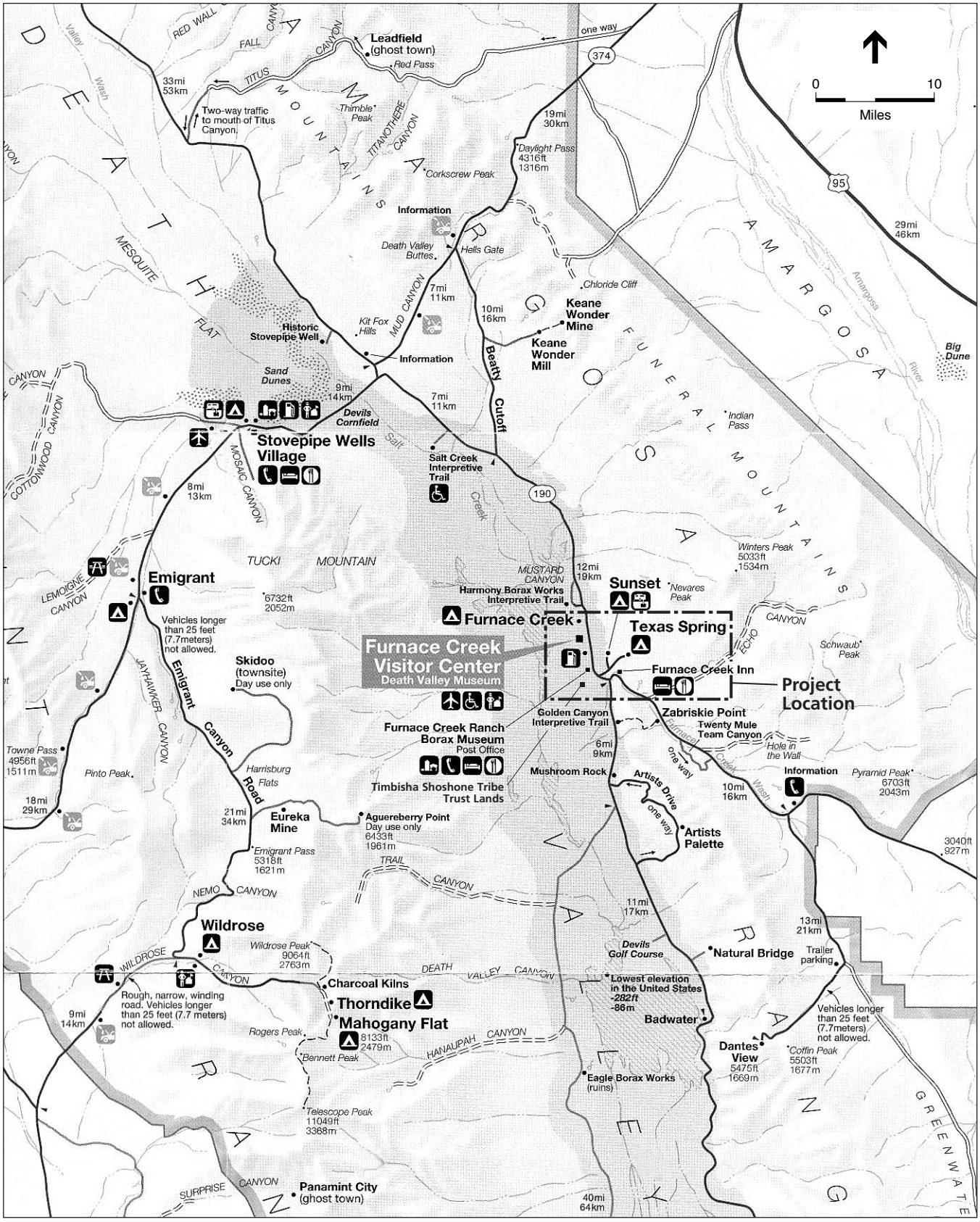
Background

The Furnace Creek area is located in the central region of Death Valley National Park (the park) in Inyo County, California (see figure I-1). The National Park Service (NPS), Xanterra Parks and Resorts (Xanterra), and the Timbisha Shoshone Tribe (tribe) are the primary water user groups in the Furnace Creek area. The Texas-Travertine Springs complex in the Furnace Creek area may be the most critical water resource in Death Valley National Park. This series of springs provides water for all of the human use needs in the park headquarters area. Major infrastructure in this area includes the primary National Park Service administrative offices, three National Park Service campgrounds, two private resort/visitor services facilities owned and operated by Xanterra, and the offices and residences for the Timbisha Shoshone Tribe. The Texas-Travertine Springs complex also provides water that supports a riparian area, a biological community that includes habitat for a minimum of eight endemic special-status species, and a biologically and culturally-important mesquite bosque.

The current water collection system consists of four water collection boxes at Travertine Springs, a collection gallery in Furnace Creek Wash, a tunnel for water collection constructed similar to a mine adit at Texas Springs, and a tunnel for water collection constructed similar to a mine adit at the Furnace Creek Inn. All water distributed by the existing collection system, except that collected at the Inn Tunnel, is potable, although much of the water is used for irrigation and other nonpotable purposes. The existing water collection system was installed in the 1970s, and has been unreliable, subject to failure, and is nearing the end of its useful life span. Many of the existing collection galleries have intermittently tested positive for coliform or E. coli bacteria, experienced unpredictable inputs of soil or organic matter, intermittently and unpredictably produced reduced volumes of water, and collected groundwater that does not meet state drinking water standards. When the system was installed approximately 30 years ago, there was an incomplete understanding of the Furnace Creek area's unique biological resource values and water conservation strategies were not a priority.

The National Park Service proposes to rebuild the antiquated water collection system in the Furnace Creek area to deliver safe and reliable drinking water to the park's main visitor use area, and provide separate delivery systems for potable and nonpotable water. As part of the redevelopment of the Furnace Creek water collection system, the National Park Service proposes to restore historic wetland and riparian habitat, and ensure the long-term conservation of species endemic to the Furnace Creek area.

Figure I-1
Project Location



SOURCE: National Park Service

Purpose of and Need for the Project

Purpose of the Project

The National Park Service is considering rebuilding the water collection system in the Furnace Creek area of Death Valley National Park. The purpose of the action is to:

- Provide a reliable quality and quantity of potable water for the National Park Service, Xanterra resort facilities (i.e., the Furnace Creek Inn and Furnace Creek Ranch), Timbisha Shoshone tribe, and park visitors
- Promote the conservation of biological and cultural resource values in the Texas-Travertine Springs area
- Enhance water resource protection and management in the Furnace Creek area

Need for the Project

This action is needed because the existing water collection system:

- Experiences unpredictable fluctuations in the volume of water that is produced. In the spring of 1998, an underground water collection gallery in Furnace Creek Wash nearly went dry even though it had produced 720,000 gallons of water per day for several years. The cause of this facility failure is believed to have been the result of channel down cutting that occurred after a flash flood in the Furnace Creek area. The down cutting event is believed to have lowered the water table below the level of the collection gallery. The resulting loss of 720,000 gallons of water per day was approximately equal to a 36% reduction in the amount of water that was available for domestic use. Since 1998, Furnace Creek Wash has resumed water supply consistent with historic water production levels.
- Produces a quality of water that does not meet state drinking water standards. Over the past several years, five of the six water collection sources have tested positive for total coliform bacteria and some of the collection sources have had documented cases of E. coli bacteria. The detection of E. coli bacteria in the drinking water supply is especially problematic, and has resulted in the issuance of emergency "boil order" notifications that have severely disrupted the delivery of water to the primary visitor use area in the park. In addition, arsenic concentrations do not meet the newly adopted federal drinking water standards for arsenic, and the system's potable water exceeds state standards for fluoride.
- Has resulted in the loss of historic wetland and riparian habitat in the Furnace Creek area. In the summer of 1999, various collection galleries in the Texas-Travertine Springs complex were systematically taken off-line because of concerns related to the presence of bacteria in the water supply. This action resulted in a condition where water that would normally have been diverted to the domestic water supply was instead released to the local environment. Park resource management staff used a Global Positioning System to accurately map the length of stream segments with and without the effects of water diversion activities and determined that Furnace Creek water collection activities are collectively responsible for the loss of seven linear miles of stream habitat when the collection galleries are fully operational.
- Provides limited flexibility for restoring habitat and species that are endemic to the Furnace Creek-Cow Creek area. Many of the existing collection galleries do not possess overflow pipes that automatically release water to the surrounding environment. The areas down-gradient of these collection galleries are largely dry, resulting in a decrease in the presence and extent of water-dependent plant and animals that were historically present. There is a limited ability to use the current infrastructure to return flows to the local environment.

- Requires the collection of water through the use of buried collection galleries dependent on two management practices that could adversely affect local plant and animal species. Park staff periodically need to replace buried collection pipes that become occluded with tree roots. This maintenance process is necessary to ensure the collection of a consistent amount of water, but typically requires the disturbance of a moderately large area in order to access and replace obstructed pipes. Proper maintenance of collection galleries also requires that the areas over the top of collection galleries be maintained in a manner that is devoid of woody vegetation. This practice is necessary in order to eliminate/reduce the presence of plant roots that promote the presence of total coliform bacteria in the water supply.
- Does not provide adequate quantification of the amount of water leaving the potable water storage tanks. The current water distribution infrastructure does not possess flow gauges that permit a fully accurate or complete accounting of the volume of water that is delivered to different water user groups or destination points. This has resulted in difficulties documenting whether each user group receives the amount of water that they are entitled to and determining where water conservation measures could be developed and implemented.

An environmental impact statement (EIS) analyzes the alternatives for the proposed actions and their impacts on the environment. This EIS has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, regulations of the Council on Environmental Quality (40 Code of Federal Regulations [CFR] 1508.9), and the National Park Service's Director's Order-12 (Conservation Planning, Environmental Impact Analysis, and Decision-making), and the National Historic Preservation Act (NHPA) of 1966, as amended, implementing regulations in 36 CFR Part 800.

Planning Context

Purpose and Significance of the Park

An essential part of the planning process is understanding the purpose and significance of the land for which the project is being prepared. In the case of federal lands, Congress provides the purpose(s) of the unit and the mission of the agency charged with managing the area. Some significant elements are often recognized in the enabling legislation. Elements of the purpose and significance of the park as identified in the park's *General Management Plan* (NPS 2002) that relate to the Reconstruction of the Furnace Creek Water Collection System are identified below.

The purpose of the park is to:

- Preserve the unrivaled scenic, geologic, and natural resources of these unique natural landscapes, while perpetuating significant and diverse ecosystems of the California desert in their natural state. Ensure the maximum protection of Wilderness values provided by law
- Preserve the cultural resources of the California desert associated with prehistoric, historic and contemporary Native American culture, patterns of western exploration, settlement and mining endeavors
- Provide opportunities for compatible public outdoor recreation and promote the public's understanding and appreciation of the California desert by interpreting the natural and cultural resources
- Retain and enhance opportunities for scientific research in undisturbed ecosystems

The significance of the park is as follows:

- Death Valley National Park contains the lowest point in North America at 282 feet below sea level. The valley floor receives the least amount of precipitation in the United States (average 1.84 inches per year) and is the site of the nation's highest and the world's second highest recorded temperature (134 degrees Fahrenheit or 57 degrees Celsius)
- Death Valley National Park is world renowned for its exposed, complex, and diverse geology and tectonics, and for its unusual geologic features, providing a natural geologic museum that represents a substantial portion of the earth's history
- Death Valley has been the continuous home of Native Americans, from prehistoric cultures to the present day Timbisha Shoshone Tribe
- The extremely colorful, complex, and highly visible geology and steep, rugged mountains and canyons provide some of the most dramatic visual landscapes in the United States
- Death Valley National Park contains one of the nation's most diverse and significant fossil records and most continuous volcanic histories
- Death Valley National Park is one of the largest expanses of protected warm desert in the world. Ninety-five percent of the park is designated Wilderness, providing unique opportunities for quiet, solitude, and primitive adventure in an extreme desert ecosystem
- Contrary to many visitors' first impression, Death Valley National Park's natural resources are extremely diverse, containing a large variety of plant species and community types. The area preserves large expanses of creosote bush valleys and other vegetation typical of the Mojave Desert. Extreme conditions and isolation provide habitat for an unusually high number of plant and animal species that are highly adapted to these conditions
- Death Valley National Park contains an unusually high number and diversity of well-preserved archeological resources

Applicable Plans and Policies

This environmental impact statement is written with the guidance of a set of regulations and policies. The project must comply with requirements of NEPA and NHPA, as well as other legislation that governs land use, natural and cultural resource protection, and other policy issues within Death Valley National Park (see Appendix A, Applicable Legislation and Policies).

A brief overview is provided below of plans, polices, and management goals that relate to the development of this environmental impact statement and form the context under which the Reconstruction of the Furnace Creek Water Collection System would be implemented.

General Management Plan

Planning in Death Valley National Park takes two different forms: general management planning and implementation planning. General management plans are required for national parks pursuant to the National Park and Recreation Act of 1978. The purpose of a general management plan is to set a "clearly defined direction for resource preservation and visitor use" (NPS 1998) and provide general directions and policies to guide planning and management in the park. The *General Management Plan* (NPS 2002) is the overall planning document for Death Valley National Park.

Implementation plans that tier from the *General Management Plan* focus on "how to implement an activity or project needed to achieve a long-term goal" (NPS 1998). Implementation plans may direct specific projects as well as ongoing management activities or programs, and provide a more extensive level of detail and analysis than a *General Management Plan*. The Reconstruction of the Furnace Creek Water Collection System is an implementation plan that tiers from the *General Management Plan* while complying with other applicable planning documents and regulations that govern land use within Death Valley National Park. The Reconstruction of the Furnace Creek Water Collection System is therefore consistent with the following management objectives and plan actions in the *General Management Plan:*

- Protect the significant natural and cultural resources and values of the park, including geologic features, and to foster an improved understanding of natural processes through monitoring efforts and scientific research
- Perpetuate and increase water resource science and conservation
- Restore to natural appearance, inasmuch as feasible, the land surfaces disturbed by man, recognizing that significant cultural values must be preserved
- Compatible with resource protection goals and carrying capacity limits, provide facilities and services to accommodate visitor needs
- Assertively compile water-related baseline data
- Seek to protect, perpetuate, and possibly restore surface water and groundwater as integral components of park aquatic and terrestrial ecosystems
- Withdraw for the park's use only the amount of surface and groundwater necessary to achieve park purposes
- Work with holders of water rights to restore modified water sources to natural conditions while still allowing for valid existing uses
- Retain water developments for native plants and wildlife that are needed to mitigate for local water losses due to previous human activities
- Restore natural water sources to be self-sustaining

National Park Service Organic Act

In 1916, this act established the National Park Service in order to "promote and regulate the use of parks…" and defined the purpose of national parks as "to conserve the scenery and natural and historic objects and wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." This law provides overall guidance for the management of Death Valley National Park. The "fundamental purpose" of the National Park System, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, is to conserve park resources and values.

The Prohibition on Impairment of Park Resources and Values

The National Park Service has a management responsibility to uphold and enact the 1916 Organic Act. While Congress has given the National Park Service the management discretion to allow certain impacts within parks, that discretion is limited by the statutory requirement that park resources and values be left unimpaired, unless a particular law directly and specifically provides otherwise. This cornerstone of the Organic Act establishes the primary responsibility of the National Park Service. It ensures that park resources and values will continue to exist in a

condition that will allow the American people to have present and future opportunities for enjoyment of them. National Park Service *Management Policies 2001* (NPS 2000f) provide guidance on addressing impairment.

Management Goals

The development of the Reconstruction of the Furnace Creek Water Collection System that meets local user group's water needs and provides for the perpetuation and restoration of water-dependent habitats and species would fulfill several management goals of the National Park Service. These goals have been described to varying degrees in the park's enabling legislation, *General Management Plan*, California Desert Protection Act, and the National Park Service *Management Policies 2001*.

Redevelopment of the Furnace Creek water collection system would achieve the following goals:

- Ensure the existing biological and cultural resources values are preserved and that historical habitats are restored to the extent that is feasible
- Meet the legal water entitlements of local user groups, i.e., the National Park Service, Xanterra Parks and Resorts, and the Timbisha Shoshone Tribe
- Provide potable water that meets California and federal water quality standards
- Improve and enhance water resource protection and management and the efficiency of water use
- Technologically facilitate the monitoring of the volume of water that enters and leaves the water collection system
- Provide the flexibility to divert water from different water sources as natural resource and maintenance needs dictate
- Ensure that the water collection system is designed to facilitate periodic maintenance activities with a minimum of environmental disturbance or elevated maintenance costs
- Address highway safety concerns of California Department of Transportation

Water Conservation Measures

In accordance with park practices, the National Park Service would continue to incorporate water conservation measures at park facilities, including low-flow toilets, drip irrigation systems, xeric landscape planting, etc., and encourage the adoption of water conservation measures by local user groups in Furnace Creek independently of the Reconstruction of the Furnace Creek Water Collection System.

Cooperating Agency and Stakeholders

The Timbisha Shoshone Tribe is a cooperating agency (as defined by the Council on Environmental Quality NEPA Regulations Section 1501.6) in the preparation of this environmental impact statement. The Timbisha Shoshone Tribe has tribal lands in the Furnace Creek area, and has water rights for the Timbisha Shoshone residential and administrative area pursuant to the Timbisha Shoshone Homeland Act. The California Department of Transportation (Caltrans) is a stakeholder in this planning process due to the proximity of the project to Highway 190. Xanterra Parks and Resorts also is a stakeholder in this planning process. Xanterra is an inholder in Furnace Creek, owner and operator of the Furnace Creek Inn and

Furnace Creek Ranch, and has water rights pursuant to a 1969 agreement between the United States of America and Fred Harvey, Inc. See Appendix B, Water Rights, for a discussion of Timbisha Shoshone Tribe, Xanterra, and National Park Service water rights.

Public Involvement

A notice of intent to prepare the Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement was published in the Federal Register on November 20, 2000. The National Park Service conducted a formal public scoping process for the Reconstruction of the Furnace Creek Water Collection System that concluded on March 14, 2001. The public was notified about the public scoping process through the Federal Register posting, local press releases, website postings, mailings, and the Furnace Creek Visitor Center newsletter. The National Park Service held three public scoping meetings on January 30 (in Pahrump, Nevada), January 31 (in Death Valley National Park), and February 1, 2001 (in Independence, California). As a result of the public scoping process, the National Park Service received a total of two letters via U.S. mail. Issues identified during the public scoping process are summarized under the Planning Issues section, below.

The Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement process was suspended for three years to address Xanterra water rights issues, and allow for data collection on Xanterra water use, Furnace Creek Wash monitoring wells, aquifer characteristics, and the endemic invertebrate species. The EIS process resumed in 2005, incorporating issues identified during the public scoping process in 2001.

Planning Issues

The following planning issues were developed from concerns raised during the public and agency scoping process, and from National Park Service staff, the Timbisha Shoshone Tribe (cooperating agency), Caltrans (stakeholder), and Xanterra (stakeholder). The first set of issues, "Issues Addressed in this Environmental Impact Statement," includes those issues specifically related to the project alternatives and addressed in this EIS. The second set of issues, "Issues Not Addressed in this Environmental Impact Statement," includes issues that are addressed in other park plans and those that are beyond the scope of this project.

Issues Addressed in this Environmental Impact Statement

The alternative that is ultimately selected to provide water for the Furnace Creek area would need to balance and address a variety of management concerns and issues that include federal and state drinking water standards, water resource protection and management issues, water user group needs, protection of endemic species habitat, maintenance of riparian plant communities, long-term facility maintenance needs, and Caltrans highway safety concerns.

Endemic Invertebrate Species

The Furnace Creek area is home to numerous endemic invertebrate species found nowhere else in the world. Plant and animal species that exist in Death Valley have developed unique survival techniques to adapt to this desert environment. The Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement addresses the protection of the park's biological resources, including the protection of endemic invertebrates.

Highway 190

Highway 190 traverses the Furnace Creek area and is one of the primary access roads to the park. Flash floods and spring releases periodically have damaged Highway 190 and disrupted this park transportation corridor, including the August 2004 flash flood event. In addition, the Furnace Creek Wash measurement box, a primary component of the park's water collection system, is located adjacent to Highway 190 and is susceptible to damage or contamination in the event of a highway accident.

Water Quality

Water quality has been a concern with the existing water collection system. The Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement addresses the provision of a reliable quantity of potable water that meets federal and state water quality standards.

Water Supply

The Furnace Creek water system is the sole provider of water to the Furnace Creek area. The antiquated water system at Furnace Creek has not provided a reliable quantity or quality of water to local users and park visitors. The National Park Service has legal obligations to provide designated amounts of water to Furnace Creek users (i.e., Xanterra and the Timbisha Shoshone Tribe) pursuant to legal water entitlements held by these users, as described in Appendix B, Water Rights. The Reconstruction of the Furnace Creek Water Collection System alternatives must meet the legal water entitlements of the local user groups. The National Park Service needs to ensure consistent provision of water that meets water quality standards to users during construction and project operation. A range of alternate designs was considered to accommodate the water supply volumes required by legal entitlements of local user groups. The Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement addresses water storage for fire protection purposes.

Dual Water System

The Furnace Creek water system provides predominantly potable water to users, with the exception of Inn Tunnel water. The Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement alternatives should develop a dual water system that provides separate potable and nonpotable water.

Water Metering

The antiquated Furnace Creek water collection and distribution system was not configured to accurately monitor quantities of water distributed to water users. The Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement alternatives improve the accuracy of systems designed to monitor water distribution and use.

Water Resource Protection and Management

The alternatives would affect the National Park Service's ability to manage and protect water resources within the Furnace Creek area of Death Valley National Park. The action alternatives include the installation of groundwater monitoring wells. These wells would be used in conjunction with existing wells to assist the National Park Service in water resource protection and management by enhancing understanding of groundwater levels and flow patterns in the

Texas Springs Syncline aquifer, and the effects that changes in groundwater levels may have on springs in the Furnace Creek area.

Issues Not Addressed in this Environmental Impact Statement

Legal Water Entitlements to Furnace Creek Users

The National Park Service has legal obligations to provide designated amounts of water to Furnace Creek users (i.e., Xanterra and the Timbisha Shoshone Tribe) pursuant to legal water entitlements held by these users, as described in Appendix B, Water Rights. The National Park Service will continue to allot water to Xanterra and the Timbisha Shoshone Tribe consistent with these legal entitlements. The provision of water to these user groups by the National Park Service associated with the Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement would not modify these legal entitlements. Similarly outside the scope of this environmental impact statement is how Xanterra and the tribe choose to use the water to which they are legally entitled. As a result, use of water in Furnace Creek for swimming pools and golf course irrigation and implementation of water conservation measures for Xanterra and tribe water use are outside the scope of the draft environmental impact statement.

Impact Topics Analyzed in this Environmental Impact Statement

The following impact topics were included for analysis in the draft environmental impact statement.

Natural Resources

National Park Service management policies and natural resource management guidelines call for the consideration of natural resources in planning proposals. The project area is located in the Furnace Creek area of Death Valley National Park between the Amargosa and Panamint Ranges—an area of abundant natural resources. It is therefore necessary to characterize these natural resources and the environmental consequences to these resources that would result from implementation of Reconstruction of the Furnace Creek Water Collection System alternatives.

The National Park Service analyzed the impacts of each alternative on the following natural resource topics: geologic resources, geologic hazards, paleontological resources, hydrology, water quality, wetlands, vegetation, wildlife, special-status species, air quality, and soundscapes. Some of the issues raised during public and internal scoping are identified below.

Geologic Resources

Death Valley's topography is the result of slow, massive geologic changes, and is an area of unique geology. The National Park Service should evaluate ground surface and subsurface disruptions on project area geology. The Furnace Creek area is susceptible to erosion. The National Park Service should take measures to protect against soil erosion when returning riparian releases to the environment.

Geologic Hazards

Death Valley is an active geologic area, including seismic activity and landslides. The National Park Service should evaluate the project alternatives with respect to seismic safety.

Paleontological Resources

The fossil remains of organisms contained in the rocks of Death Valley are nearly as extensive and complex as the geology itself. An important component of the planning effort is to ensure the protection of paleontological resources.

Water Quality

Water quality has been a concern with the existing water collection system. The National Park Service needs to provide a reliable quantity of potable water that meets federal and state water quality standards. The draft environmental impact statement analyzes the effects of the alternatives on water quality.

Biological Resources

The Furnace Creek area is home to numerous endemic invertebrate species found nowhere else in the world. Plant and animal species that exist in Death Valley have developed unique survival techniques to adapt to this desert environment. Most wildlife activity is concentrated around springs, and many animals are strictly nocturnal. The Reconstruction of the Furnace Creek Water Collection System should ensure the preservation of the park's biological resources, including the protection and restoration of native vegetation and endemic invertebrates. The project area includes a biologically and culturally important mesquite bosque that should be protected under this planning effort.

Soundscapes

Natural quiet is an important component of the visitor experience in a national park, and also beneficially contributes to wildlife habitat. The park should minimize noise during water system construction and system operation.

Cultural Resources

National Park Service management policies and cultural resource management guidelines call for the consideration of cultural resources in planning proposals and environmental compliance documentation. The native people of Death Valley, the Timbisha Shoshone Tribe, believe that they have lived in Death Valley since time immemorial and archeological evidence indicates that Native American cultures have lived in the Death Valley area for at least 10,000 years. Traditionally, the Timbisha Shoshone lived on game, mesquite beans, and piñon nuts. They camped in the valley near water sources, such as Texas-Travertine Springs, during the winter and moved into the cooler mountains during the summer. The first euroamericans entered Furnace Creek Wash in 1849 while looking for a short-cut to the California gold fields. Although Death Valley was subject to a series of mining booms, the most profitable and longest-sustaining mining activities in the region centered on borates, and resulted in the Harmony Borax Works and the famous 20-mule-team wagons to haul borax across the desert. The Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement considers impacts to archeological resources, historic structures, ethnographic resources, and cultural landscape resources in the Furnace Creek area. An important component of the planning effort is to ensure the protection and preservation of cultural resource values, and avoid adverse impacts to cultural resources including archeological sites, historic structures, and ethnographic areas such as the mesquite bosque.

Other Resource Issues

The Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement examines the effects of the project alternatives on the social environment within the park. The mission of Death Valley National Park is to protect the park's significant desert features that provide world class scenic, scientific, and educational opportunities for visitors and academics to explore and study. The Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement considers the effects of the alternatives on visitor experience, transportation, scenic resources, socioeconomics, and park operations and facilities. Some of the issues raised during public and internal scoping are identified below.

Visitor Experience

Furnace Creek is one of the primary destinations for park visitors, including the Furnace Creek visitor center and three park campgrounds. Xanterra's private inholdings include two visitor lodging facilities, Furnace Creek Inn and Furnace Creek Ranch. Xanterra operates an 18-hole golf course and two swimming pools in Furnace Creek. The Furnace Creek area is surrounded by designated Wilderness. The Reconstruction of the Furnace Creek Water Collection System would provide potable and nonpotable water for park visitors consistent with the legal water entitlements of the local users.

Transportation

Highway 190 traverses the Furnace Creek area and is one of the primary access roads to the park. Flash floods and spring releases have periodically damaged Highway 190 and disrupted this park transportation corridor. In addition, the Furnace Creek Wash measurement box, a primary component of the park's water collection system, is located adjacent to Highway 190 and is susceptible to damage or contamination in the event of a highway accident.

Scenic Resources

Protection of scenic resources is an important component of the park's enabling legislation, and conserving the park's scenery is a crucial component of the National Park Service 1916 Organic Act. The National Park Service should minimize negative visual impacts to enhance visitor enjoyment of the park. The National Park Service should develop non-intrusive design concepts to minimize disruptions to park scenery during project construction and subsequent system operation.

Park Operations and Facilities

The Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement considers the quality and effectiveness of the park's infrastructure to adequately protect and preserve vital resources and provide for an effective visitor experience. The antiquated water system at Furnace Creek has not provided a reliable quantity or quality of water to local users and park visitors. The National Park Service should ensure the provision of consistent water supplies that meets drinking water standards during the implementation of the project. The park should ensure the availability of a sufficient water supply for fire protection.

Impact Topics Dismissed from Further Analysis in this Environmental Impact Statement

The following impact topics were dismissed from further analysis in the environmental impact statement.

Environmental Justice

Environmental justice analyses determine whether a proposed action would have "disproportionately high and adverse human health or environmental effects on minority populations and low-income populations." The National Park Service and other federal agencies have determined that a disproportionately high and adverse effect on minority and low-income populations means an adverse effect that would result in either of the following two scenarios:

- The effect is predominately borne by a minority population and/or a low-income population
- The effect will be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority population and/or non-low-income population

No aspect of any alternative of the Reconstruction of the Furnace Creek Water Collection System would result in disproportionately high and adverse human health or environmental effects on minority or low-income populations; therefore, environmental justice is not considered in this environmental impact statement. Under Alternative 1, all water users (e.g., the National Park Service, Xanterra, park visitors, and the Timbisha Shoshone Tribe) in Furnace Creek would be similarly exposed to water that does not meet state drinking water standards. Under the action alternatives, all water users would receive potable water that meets state drinking water standards. In addition, all water users would receive water amounts consistent with their legal entitlements.

Indian Trust Resources

Indian trust resources are assets owned by American Indians that are held in trust by the United States. Requirements for management of Indian trust resources are included in the Secretary of the Interior's Secretarial Order 3206, American Indian Tribal Rites, Federal – Tribal Trust Responsibilities, the Endangered Species Act, and Secretarial Order 3715, Departmental Responsibilities for Indian Trust Resources. According to Death Valley National Park staff, Indian trust resources do not occur within the park. Therefore, there would be no effect on Indian trust resources associated with the project alternatives.

Land Use

Furnace Creek is somewhat unusual with respect to land uses in a national park. Typically, land within a national park is owned by the federal government and is classified as "parkland" regardless of the land use. In addition to national park land, Furnace Creek also includes Xanterra's private inholdings (i.e., Furnace Creek Inn and Furnace Creek Ranch) and Timbisha Shoshone Tribe trust lands. In addition, a portion of the land owned by the National Park Service adjacent to the Timbisha Shoshone Tribe trust lands is designated as Timbisha Shoshone Tribe Buffer Land and the mesquite bosque south and west of the Timbisha Shoshone land is designated as Timbisha Shoshone Tribe Mesquite Use Area. These designations and land ownership are described in Appendix C, Land Use. The alternatives would have no measurable

impacts on land use, occupancy, income, values, ownership, or type of use on any of these lands, regardless of ownership or designation. Therefore, no further discussion of land use is required in this environmental impact statement.

Lightscapes

The scarcity of development in the park and surrounding area provide outstanding night sky viewing opportunities. Implementation of the Reconstruction of the Furnace Creek Water Collection System would not affect visibility of the night sky or otherwise affect lightscapes in the Furnace Creek area. New lighting sources would be limited to the reverse osmosis water treatment plant, which would include dark-sky compatible outdoor security lighting with motion detectors, in compliance with Mitigation Measures listed in Appendix D. The project would not create light trespass in Wilderness.

Museum Collections

Implementation of the Reconstruction of the Furnace Creek Water Collection System would not affect the National Park Service museum collections. The redevelopment of the water collection and distribution system in Furnace Creek would have no effect on the park's museum collections.

Prime and Unique Agricultural Lands

There are no agricultural lands in the project area, nor would the proposed action under the project alternatives have indirect effects on downstream agricultural lands. Although agricultural uses occur within the project area, specifically the date orchards at Furnace Creek Ranch and mesquite bosque harvesting by the Timbisha Shoshone Tribe, the U.S. Department of Agriculture, Natural Resource Conservation Service (formerly the Soil Conservation Service) has not identified prime or unique agricultural soils within the project area. Thus, no further discussion of this topic is necessary.

Public Health and Safety

Public health and safety is not presented as a separate topic in this analysis, since other sections (e.g., water quality, transportation, and visitor experience) evaluate park-related public health and safety issues.

Environmental Impact Statement Organization

The preferred and alternative plans for the Reconstruction of the Furnace Creek Water Collection System and its environmental impact statement, which evaluates the potential impacts of the alternatives, are integrated in this document and will be referred to collectively as the Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement. The contents of the main body of this document are as follows:

Chapter I: Purpose and Need

This first chapter of the EIS includes a discussion of the project's background, purpose and need, planning context, cooperating agencies and stakeholders, public involvement, planning issues, impact topics analyzed in this EIS and impact topics dismissed from further analysis in this EIS.

Chapter II: Alternatives

This chapter presents the project alternatives considered by the National Park Service for the Reconstruction of the Furnace Creek Water Collection System, as well as the alternatives considered but dismissed from further analysis. This chapter includes summary tables of the key features of the four project alternatives, and an environmental consequences summary table at the end of the chapter.

Chapter III: Affected Environment

This chapter provides an overview of the affected environment of the Furnace Creek system and its surroundings. The affected environment provides a description of the existing condition of geologic resources, geologic hazards, paleontological resources, hydrology, water quality, wetlands, vegetation, wildlife, special-status species, air quality, soundscapes, cultural resources, visitor experience, transportation, scenic resources, socioeconomics, and park operations and facilities in the Furnace Creek area.

Chapter IV: Environmental Consequences

This chapter presents an analysis of the potential environmental impacts of each alternative, including impact context, duration, intensity, and type. Chapter IV, Environmental Consequences, presents an analysis of cumulative impacts, as well as an analysis of potential impairment of park resources resulting from the alternatives.

Chapter V: Consultation and Coordination

This chapter summarizes the process relied upon in preparing and reviewing this document. This chapter provides a brief history of public involvement, a list of preparers and reviewers and their expertise, and a list of recipients of the EIS.

Chapter VI: References

This chapter identifies the references used in preparing the EIS, including the document bibliography and glossary.

Chapter II: Alternatives

Death Valley, California, 1871. Photo by Timothy O'Sullivan for the Wheeler Survey.
Courtesy U.S. National Archives and Records Administration, catalog number 106-WB-62.

Chapter II: Alternatives

The National Park Service (NPS) is preparing the Reconstruction of the Furnace Creek Water Collection System Draft Environmental Impact Statement to analyze the development of a water collection system that would provide a reliable quantity and quality of domestic water consistent with established water rights agreements for local uses and federal and state water quality standards, and meet the park's natural and cultural resource conservation management goals in the project area.

Overview of the Alternatives

The current water collection system consists of four water collection boxes at Travertine Springs, a collection gallery in Furnace Creek Wash, a tunnel for water collection constructed similar to a mine adit at Texas Springs, and a tunnel for water collection constructed similar to a mine adit at the Furnace Creek Inn (Inn Tunnel). Death Valley is the terminus of a regional aquifer system known as the Death Valley Regional Ground Water Flow System (regional flow system). Aquifers in the regional flow system typically are present in unconsolidated and consolidated alluvial deposits, volcanic rocks, and carbonate limestone and dolomite. Much of the regional flow system is underlain by a reasonably continuous carbonate aquifer system known as the Lower Carbonate Aquifer. Springs in the Furnace Creek area discharge from the regional flow system and the water is believed to originate from the Lower Carbonate Aquifer where the aquifer is present in the southern Funeral Mountains. Water then percolates through consolidated and unconsolidated alluvial materials of the Texas Springs Syncline before it surfaces. The National Park Service, Xanterra Parks and Resort (Xanterra), and the Timbisha Shoshone Tribe (tribe) are the primary water user groups in the Furnace Creek area. All water distributed by the existing collection system, except that collected at the Inn Tunnel, is potable, although much of the water is used for irrigation and other nonpotable purposes.

This chapter identifies and describes four alternatives, including the No Action Alternative (Alternative 1) and the Preferred Alternative (Alternative 3). The No Action Alternative represents the status quo; the existing facilities would remain unchanged, except for normal maintenance and repair. It provides the basis for comparison of each action alternative. Alternative 2, Alternative 3, and Alternative 4 (the action alternatives) would rebuild the outdated water collection system in the Furnace Creek area to deliver a safe and reliable potable and nonpotable water supply to the park's main visitor use area. All three action alternatives would separate the potable and nonpotable water system in the project area, and provide nonpotable water from the Inn Tunnel and a relocated Furnace Creek Wash collection gallery. Alternative 2 would provide potable water from rebuilt collection galleries at Travertine Springs Lines 3 and 4, and two new groundwater wells in the Texas Springs Syncline. Alternative 2 would treat water collected for potable purposes using a reverse osmosis water treatment plant and would discharge concentrate water from the water treatment process to a percolation trench in Furnace Creek Fan for groundwater recharge. Alternative 3 (Preferred) would provide potable water from two to three new groundwater wells in the Texas Springs Syncline, and would treat water collected for potable purposes using a reverse osmosis water treatment plant; concentrate water generated from the water treatment process would be discharged to a percolation trench in Furnace Creek Wash for groundwater recharge. Alternative 4 would provide potable water from Travertine Springs Lines 2, 3, and 4 and Texas Springs, and would treat water collected for potable purposes

using a reverse osmosis water treatment plant. Concentrate water from the water treatment process would be discharged to a tributary of Texas Springs Wash.

The National Park Service (the National Environmental Policy Act [NEPA] lead agency) and the Timbisha Shoshone Tribe (the NEPA cooperating agency) developed the range of alternatives through public and agency input during the public scoping process, a series of internal scoping meetings and workshops with National Park Service staff and tribal representatives, and meetings with stakeholders (including the California Department of Transportation [Caltrans] and Xanterra). Factors influencing the final range of alternatives include: ensuring consistency with applicable policies and management objectives identified in the park's *General Management Plan* (NPS 2002), fulfilling the project's purpose and need and management goals, complying with state and federal drinking water standards, conserving endemic invertebrate species and their spring habitats, supplying water to local users consistent with their legal water entitlements, maintaining the security of federal water rights from upgradient uses, improving the efficiency of park operations, maintaining Highway 190 safety, and improving flow to the biologically and culturally important mesquite bosque.

The methods that would be used to collect potable water and dispose of the concentrate water from the reverse osmosis plant vary in each of the action alternatives. Each of the methods would be feasible, and are fully evaluated in this environmental impact statement. The National Park Service has identified its preferred methods, and a logical pairing of the other potable water collection and concentrate water disposal options. Although the methods are identified in separate alternatives, each method would be feasible and could be selected should new information regarding the feasibility of implementing the preferred alternative be revealed during public review or agency consultation.

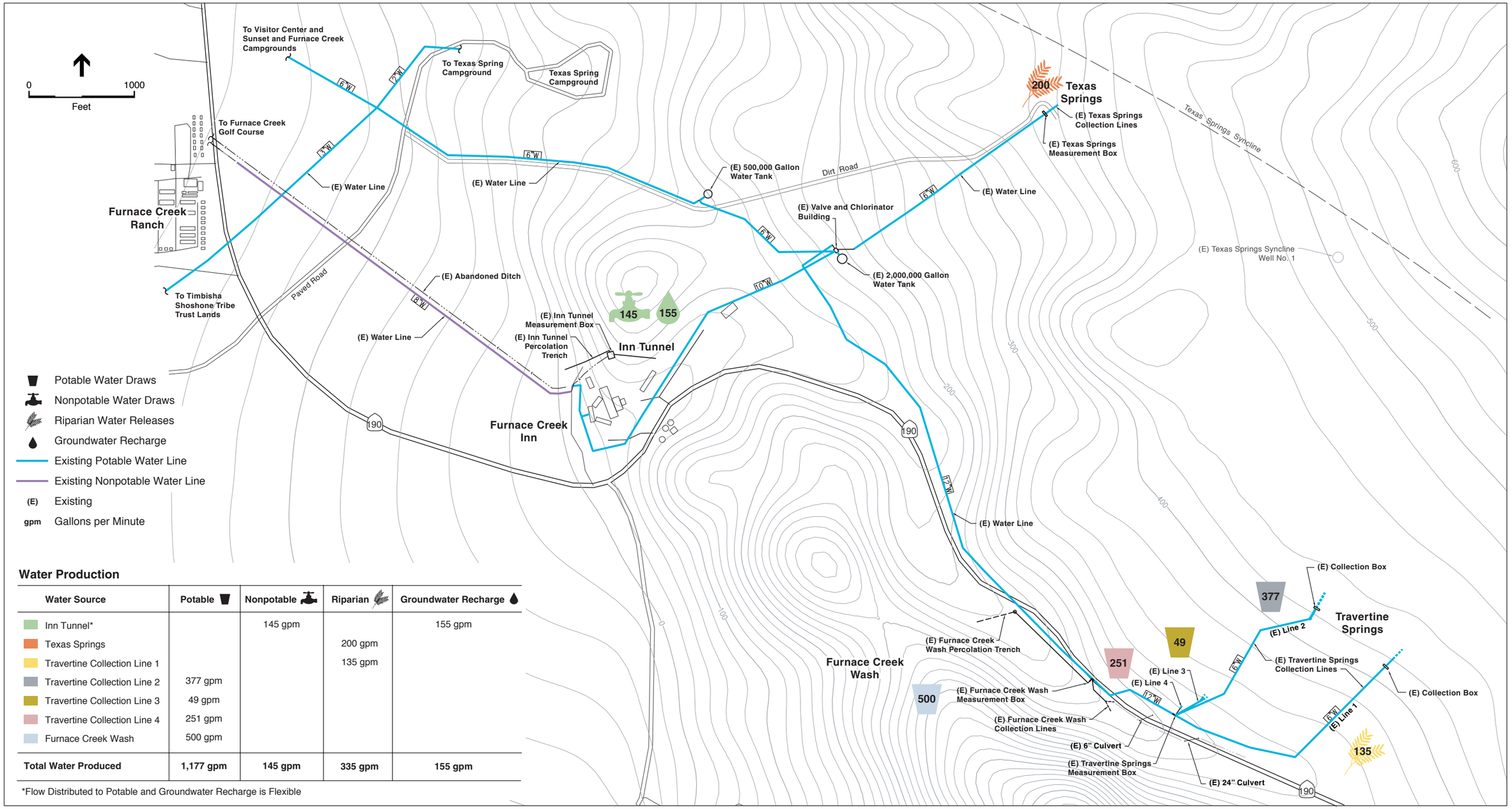
Alternative 1 (No Action)

Under Alternative 1, the existing conditions in the project area would be maintained as described in Chapter III, Affected Environment (see figure II-1). Alternative 1 provides a baseline from which to compare the action alternatives, evaluate the magnitude of proposed changes, and measure the environmental effects of those changes. This no action concept follows the guidance of the Council on Environmental Quality, which describes the No Action Alternative as representing no change from the existing management direction or level of management intensity. The baseline conditions for the Reconstruction of the Furnace Creek Water Collection System are described below.

The No Action Alternative represents ongoing implementation of the current management direction for the Travertine-Texas Spring water collection system. Under this alternative, no comprehensive changes or new management activities would take place with respect to the Furnace Creek water supply. Alternative 1 represents the management approach that the National Park Service is currently following, and would continue to follow if no further agency action were taken.

The Furnace Creek water collection system consists of four individual water sources, which supply potable and nonpotable water to the Furnace Creek area. Figure II-1 shows the existing water collection system. Travertine Springs and Furnace Creek Wash provide potable water to the facilities within the Furnace Creek area. The Inn Tunnel supplies nonpotable water to Xanterra. Alternative 1 would continue to supply 1,177 gallons per minute (gpm) of potable water

Figure II-1
Alternative 1 (No Action)



Water Production

Water Source	Potable	Nonpotable	Riparian	Groundwater Recharge
Inn Tunnel*		145 gpm		155 gpm
Texas Springs			200 gpm	
Travertine Collection Line 1			135 gpm	
Travertine Collection Line 2	377 gpm			
Travertine Collection Line 3	49 gpm			
Travertine Collection Line 4	251 gpm			
Furnace Creek Wash	500 gpm			
Total Water Produced	**1,177 gpm**	**145 gpm**	**335 gpm**	**155 gpm**

*Flow Distributed to Potable and Groundwater Recharge is Flexible

SOURCE: Psomas and Environmental Science Associates

and 145 gpm of nonpotable water. Water from Texas Springs would continue to be released for riparian purposes and would not be used for potable supplies due to water quality issues. Flow from Texas Springs (200 gpm) and Travertine Springs Line 1 (135 gpm) would continue to be discharged at the spring collection boxes and would be available for riparian resources downstream of the springs. Approximately 155 gpm of water collected from the Inn Tunnel would be returned to the groundwater flow system in a percolation trench for groundwater recharge (see table II-1).[1] The No Action Alternative would continue to supply an unreliable amount of water to users. In addition, the water quality would continue to not meet drinking water standards.

Generally, the water from the Travertine Springs and Furnace Creek Wash flows by gravity to a 2-million gallon tank located northeast of the Furnace Creek Inn. An overflow valve on the 2-million gallon tank automatically discharges water collected from Travertine Springs and Furnace Creek Wash into a 10-inch pipe that extends approximately 40 feet from the tank and releases water onto the ground surface when levels in the tank exceed capacity. Substantial erosion has resulted from intermittent releases of water from the tank. From the 2-million gallon tank, a portion of the water is delivered directly to Xanterra facilities (Furnace Creek Inn, Furnace Creek Ranch, and Furnace Creek Golf Course) and a portion is transported to a 500,000-gallon tank. From the 500,000-gallon tank the water flows by gravity to National Park Service facilities, including park headquarters, visitor center, and three campgrounds, and to the Timbisha Shoshone Tribe residential/administrative area. Nonpotable water from the Inn Tunnel flows by gravity to Xanterra facilities for irrigation purposes. The four water sources are described in greater detail below.

Average Water Usage

Under Alternative 1, the National Park Service would continue to use approximately 63 gpm of potable water. The Tribe would use approximately 57 gpm of potable water. On average, Xanterra would continue to use 223 gpm of potable water and 780 gpm of nonpotable water.[2]

Travertine Springs

Travertine Springs are located within riparian habitat approximately one mile southeast of the 2-million gallon water tank and north of Highway 190. Four separate collection lines make up the Travertine Springs water system (see figure II-1).

The Line 1 collection system consists of an approximately 120-linear-foot collection trench. The collection trench connects to a pipe, which in turn enters a collection box. Within the collection box there are two outlet pipes. One is a 6-inch pipe that directs water to the Travertine Springs measurement box and one is a 6-inch overflow pipe, which drains to the surrounding environment. In the past, Line 1 has supplied potable water to the Furnace Creek area. In order to enhance riparian areas in Travertine Springs and Furnace Creek Wash, water collection at Line 1 has been discontinued and spring flow released for riparian purposes. The water from Line 1 would continue to be released to the riparian area.

1 Flow rates and water usage identified under each alternative associated with water draws from Travertine and Texas Springs, Furnace Creek Wash, the Inn Tunnel, and the proposed groundwater production wells (under Alternatives 2 and 3) would be approximate. These flow rates would be used for water collection system design purposes, and actual flows may vary slightly.

2 The Xanterra nonpotable water use figure does not specifically delineate water from the Inn Tunnel used to irrigate the Furnace Creek Golf Course. Water from the Furnace Creek Inn and Furnace Creek Ranch swimming pools (i.e., flow-through water) and from the Inn Tunnel would continue to be the primary source of irrigation water for the golf course.

The Line 2 collection system consists of two 160-linear-foot collection trenches. The two collection trenches connect to two pipes, which in turn enter a collection box. Within the collection box there are two outlet pipes. One is a 6-inch pipe that directs water to the Travertine Springs measurement box and one is an 8-inch overflow pipe, which drains to the surrounding environment.

The Line 3 collection system consists of two 80-linear-foot collection trenches. The two collection trenches join and connect to a 6-inch pipe. There is no collection box for Line 3; rather the 6-inch pipe runs directly to the Travertine Springs measurement box. There is an overflow line along the 6-inch pipe.

The Line 4 collection system consists of a collection trench that connects to a 6-inch pipe, which in turn ties into the Travertine Springs measurement box. Line 4 contains an overflow line along the 6-inch pipe.

The water from the four collection lines would continue to be routed to a common collection point (Travertine Springs measurement box). From the measurement box the water would be transported under Highway 190 via a 12-inch pipe to the Furnace Creek Wash measurement box. Any excess water in the Travertine Springs measurement box would exit through a 10-inch overflow pipe. The overflow pipe traverses under Highway 190, and outlets into a concrete ditch alongside the highway. A 24-inch diameter culvert would continue to be located under Highway 190 in the vicinity of Travertine Springs to convey water under the highway.

Traces of total coliform and E. coli have periodically been detected in the Travertine Springs water supply. Contamination of the collection system could be due to organics in the soil or surface water influence. During periods of contamination, the water has been diverted to the overflow lines of each collection system and released to the surrounding riparian area.

Texas Springs

Texas Springs is located within a riparian habitat approximately 2,500 feet northeast of the 2-million gallon water tank. Two collection galleries collect water within the Texas Springs tunnel. Two pipes exit the tunnel and convey the water to a measurement box. Prior to entering the measurement box the two water lines combine into one pipe. At the measurement box the water flows by gravity to the 2-million gallon water tank via a 6-inch pipe. Any excess water bypasses the outlet pipe and enters a 6-inch overflow pipe. The overflow pipe drains to the local riparian habitat.

In the past, Texas Springs has supplied potable water to the Furnace Creek area. However, traces of total coliform and E. coli bacteria have been detected in the Texas Springs water supply, resulting in the discontinuation of water collection at Texas Springs for potable use and release of spring flow for riparian purposes. The water from Texas Springs would continue to be released to the riparian area due to contamination in the water supply. The source of contamination is suspected to be from organics in the soil and from rodent feces.

Erosion, primarily in the form of gullying, has resulted from releasing Texas Springs to the surrounding riparian area; however, the extent of riparian vegetation has increased since the initiation of water releases.

Furnace Creek Wash

The Furnace Creek Wash collection system is located within riparian habitat approximately 1 mile south of the 2-million gallon water tank, and south of Highway 190. The collection system for Furnace Creek Wash would continue to consist of two collection trenches that connect to a pipe, which enter the Furnace Creek Wash measurement box. Water from the Travertine Springs measurement box would continue to join water collected from the Furnace Creek Wash, and would be gravity fed to the 2-million gallon water tank via a 12-inch pipe. Within the measurement box there would continue to be a 12-inch overflow pipe that directs any excess water to a percolation trench.

The 12-inch water line from the Furnace Creek Wash measurement box to the 2-million gallon tank would continue to have several high spots. Air relief valves would continue to be located at these points to release air from the pipeline. The air relief valves are old and the National Park Service is not certain if they are operable.

National Park Service staff have noticed a back-up of water at the Furnace Creek Wash measurement box. The cause of the back-up could be due to old air relief valves not allowing air to escape the pipeline (i.e., air locking), thus reducing the capacity of the pipeline. In order to accurately determine the cause of the air locking, the air release valves should be inspected to ensure they are working properly.

Inn Tunnel

The Inn Tunnel is located north of the Furnace Creek Inn, and would continue to supply nonpotable water to the Furnace Creek Ranch and the Furnace Creek golf course. Groundwater would continue to be collected by horizontal well points at the end of the mine adit. Collected water flows by gravity into a pipeline, and then to a measurement box. The measurement box would continue to have an outlet pipe that delivers nonpotable water to Xanterra facilities through an open channel and a pipeline. In addition, the measurement box would continue to have an 8-inch overflow pipe, which directs a portion of the water to a percolation trench that returns water to the groundwater flow system for groundwater recharge. Water directed to the percolation trench would be available for use at the mesquite bosque on the Furnace Creek Fan.

Water production under Alternative 1 is summarized in table II-1.

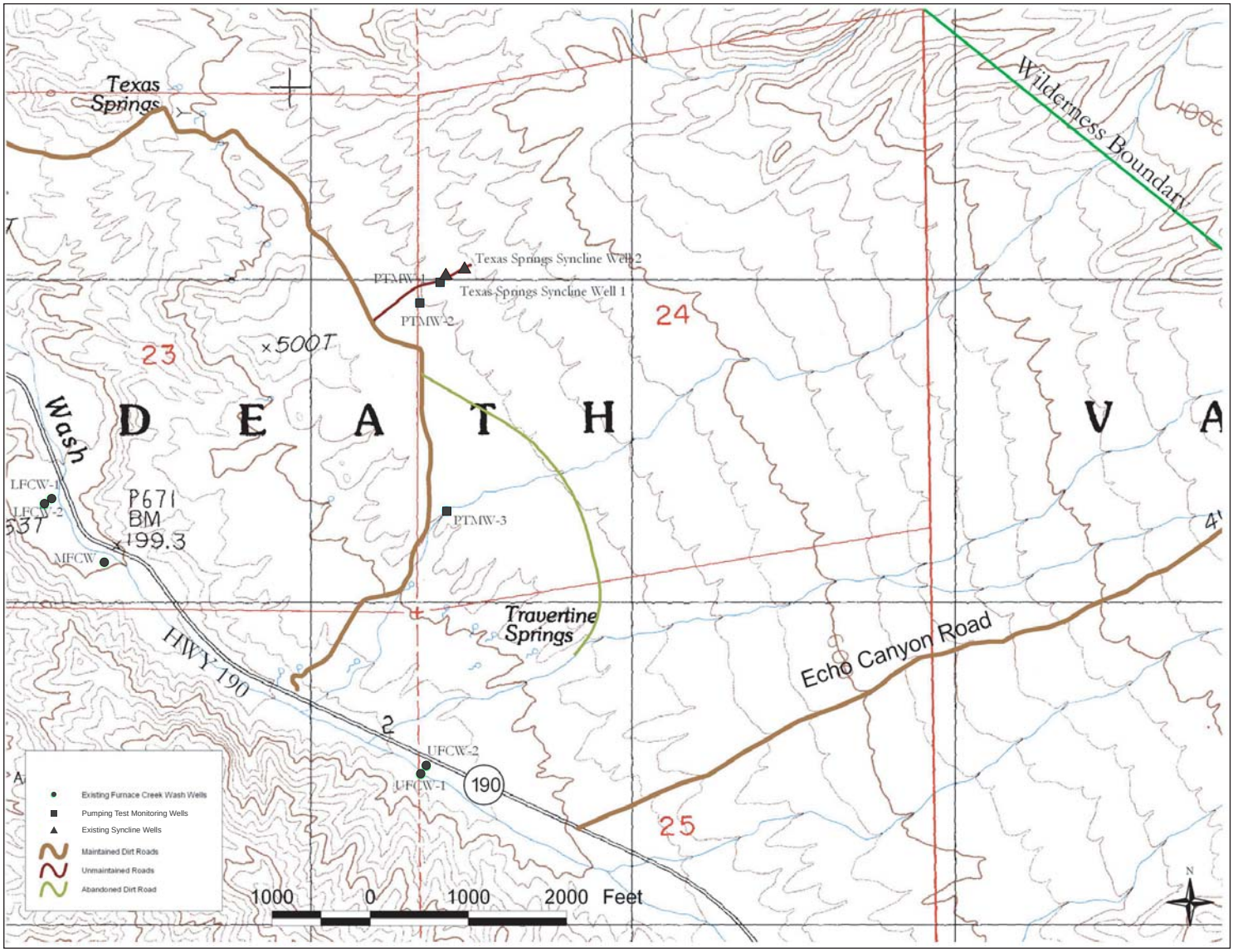
Groundwater Monitoring Wells

The National Park Service has 10 existing groundwater monitoring wells in the Furnace Creek area. These wells are used for long-term monitoring of groundwater levels to assist the National Park Service in water resource protection and management by establishing baseline groundwater levels and identifying future trends in groundwater levels, and defining the water balance for the Furnace Creek area. The locations of these monitoring wells are shown in figure II-2.

Water Treatment

Water intended for potable use would continue to be disinfected at the 2-million gallon tank with chlorine. There would continue to be a small building/vault near the 2-million gallon storage tank to house the small disinfection system.

Figure II-2
Alternative 1 (No Action)



SOURCE: National Park Service and Environmental Science Associates

Fire Safety Water Storage

The Furnace Creek area would continue to have a maximum of 2.5-million gallons of water storage available for use in the event of a fire emergency. This volume of water storage meets the National Fire Protection Association standards (Psomas 2004).

Ongoing Vegetation Management

The National Park Service would continue to conduct native plant restoration programs under Alternative 1. Plantings would consist of species native to the park or historically appropriate for the period or event commemorated. The use of nonnative species would conform to the National Park Service exotic species policy (NPS 1988). To the extent feasible, the park would continue to remove tamarisk as part of the on-going tamarisk control program. However, in areas where herbicides cannot be used due to potential contamination to the water supply, such as at Travertine Springs, tamarisk trees would not be removed. Date palm and California fan palm may be removed if it is determined that these species are not part of the historical landscape.

Elements Common to All Action Alternatives

The following elements would be common to Alternative 2, Alternative 3, and Alternative 4 (the action alternatives).

Water Usage

The Reconstruction of the Furnace Creek Water Collection System alternatives would be designed to meet peak water demand periods when (1) Furnace Creek facilities are at full occupancy and require their maximum daily flows, and (2) during the peak irrigation season when the Furnace Creek Inn and Ranch grounds and golf course require their maximum daily flows of irrigation water. The maximum daily flow requirements would need to be met approximately 10% of a calendar year. The average daily flow requirements would need to be met 100% of the calendar year, and would constitute the water withdrawals from the Furnace Creek system approximately 90% of the year.

Maximum Daily Flow Requirements

The action alternatives have been designed to meet the maximum daily flow requirements of the Furnace Creek water users. The maximum daily flow requirements (over a 24-hour period) are 600 gpm of potable water and 900 gpm of nonpotable water. The water withdrawals from the water sources to meet the maximum daily flow requirements are shown in table II-1.

Average Daily Flow Requirements

Under the action alternatives, the National Park Service's average water usage would be approximately 63 gpm of potable water. The Tribe's average water usage would be approximately 57 gpm of potable water. Xanterra's annual average water usage would be 223 gpm of potable water and 780 gpm of nonpotable water.[3] As noted in Appendix G, Water Use, Xanterra's monthly potable and nonpotable average water use is highest during the summer months and lowest during the winter months, resulting in an overall seasonal fluctuation in average potable

3 The Xanterra nonpotable water use figure does not include water used to irrigate the Furnace Creek Golf Course. Water from the Furnace Creek Inn and Furnace Creek Ranch swimming pools and from the Inn Tunnel would continue to be the primary source of irrigation water for the golf course.

and nonpotable demand. However, this variation in seasonal average demand is not substantial, and while seasonal patterns may raise or lower average daily demand, these variations are not anticipated to have substantial ramifications in the action alternatives beyond those associated with the annual average demand. Overall, average daily flow requirements (over a 24-hour period) would be 343 gpm of potable water and 780 gpm of nonpotable water.

Water withdrawals of 429 gpm from the water sources would be needed to meet the average daily flow requirements as shown in table II-2 and discussed in Water Treatment sections below.

Water Treatment

Under all action alternatives, water intended for potable use would be treated using reverse osmosis water treatment technology. The National Park Service would construct a reverse osmosis treatment plant consisting of pre-filtration and post-disinfection to remove viruses, bacteria, metals, arsenic, boron, fluoride, and total dissolved solids (TDS). The reverse osmosis treatment plant would be housed in an approximately 40-foot by 60-foot structure located near the 2-million gallon water storage tank and would have a treatment capacity of approximately 1 million gallons per day. The water treatment plant would include dark-sky compatible outdoor security lighting with motion detectors. A 1,500-gallon septic tank and 200-foot by 10-foot leach field would be installed adjoining the reverse osmosis water treatment plant to manage sewage flows produced by a bathroom for treatment plant employees.

Reverse osmosis water treatment plants produce a concentrate water output flow of approximately 20% of raw water input, thereby requiring raw water inflow volumes of 120% of desired treated water output volumes. To meet the average daily potable water flow requirement of 343 gpm, the National Park Service would need to supply 429 gpm of untreated, raw water to the water treatment plant.

To meet maximum daily flow requirements of 600 gpm of treated potable water(which needs to be met approximately 10% of the calendar year), the National Park Service would supply 600 gpm of untreated, raw water to the water treatment plant to provide an output of 480 gpm of treated potable water; the National Park Service also would rely upon drawdown of 120 gpm of stored, treated water in the 2-million gallon and 500,000-gallon tanks, rather than increasing raw water collection rates.

Water Meters

Under all action alternatives, the National Park Service would install a water metering system to accurately monitor the distribution of water in the Furnace Creek system.

Groundwater Monitoring Wells

The National Park Service has 10 existing groundwater monitoring wells in the Furnace Creek area. These wells are used for long-term monitoring of groundwater levels to assist the National Park Service in water resource protection and management by establishing baseline groundwater levels and identifying future trends in groundwater levels, and defining the water balance for the Furnace Creek area. The locations of these monitoring wells are shown in figure II-2. The National Park Service could continue long-term monitoring of groundwater levels using these 10 existing wells under each of the action alternatives.

Riparian Water Releases

Each of the action alternatives identifies riparian water releases to restore historic wetland and riparian habitat. The National Park Service would use the following general approach to return Travertine and Texas riparian spring water to the surface to address energy dissipation, reduce evaporative losses, slow water surface flow velocity to promote infiltration back into the subsurface, and reduce erosion.

- Penetrate the sides of collection boxes to install dispersion piping and valves so that spring water can be dispersed and released gradually. Perforate the sides of the collection boxes above the piping/valves to allow additional water releases from the sides of the collection boxes. Increased releases may be made over time as native riparian vegetation re-establishes.
- Build narrow and shallow infiltration ditches downstream of the spring outlet to provide the spring water with a preferential pathway for reinfiltration of unused water gathered from the spring collection system. The infiltration ditches would be approximately 6 inches to 1 foot deep. The trenches would be filled with permeable backfill, and may include drip systems or weep pipes. The infiltration ditches would be oriented downslope and cross-contour.
- Install temporary ground diffusion piping (for a season or two) to disperse spring water on the surface until soil moisture and riparian vegetation can reach a reasonable equilibrium.
- Place straw waddles (with weed-free straw) cross slope to avoid excessive erosion and runoff, and to assist in establishing a saturation zone to promote water infiltration.
- Plant additional native riparian vegetation to promote groundwater infiltration and reduce evaporative losses and erosion.
- Place riprap on the outlet side of the culverts traversing Highway 190. Develop a vegetated swale down gradient from the culvert outlet to dissipate water energy, promote groundwater infiltration, and disperse water releases in Furnace Creek Wash.
- Riparian water flow in Furnace Creek Wash would largely follow the natural channel and remnants of an historic ditch parallel to and south of Highway 190. Earthwork would occur near Travertine Springs to create an initial flow pathway for riparian water, and downstream of the proposed Furnace Creek Wash collection gallery to strengthen an existing earthen berm that prevents riparian flows from following the natural channel and re-crossing to the north side of Highway 190. Approximately 300 feet of open concrete channel would be installed along Highway 190 where the proximity of rock outcrops to the highway is too narrow to adequately convey riparian flows.

Alternative Energy Generation Measures

To the extent feasible, the National Park Service would incorporate alternative energy generation measures, such as solar energy and hydroelectric technology. Solar panels would be installed on the roofs of the water treatment plant and the pump houses generating approximately 500 watts of electricity to operate low voltage lighting, telemetry equipment, exhaust fans, or non-essential controls and instrumentation.

A 65-horsepower hydroelectric turbine would be installed approximately 200 feet downgradient from the water treatment plant and would generate approximately 45 kilowatts of energy. The National Park Service would tie this power into its existing electrical grid, and would receive energy credits from Cal Edison. The turbine would be housed in an approximately 20-foot by 20-foot structure.

Alternative 2

Alternative 2 would provide potable water from Travertine Springs Line 3 and Line 4, and from two groundwater production wells located in the Texas Spring Syncline (see figures II-3 and II-4). Nonpotable water would be collected from Furnace Creek Wash and the Inn Tunnel. Water for riparian restoration purposes would be released from Texas Springs and Travertine Springs Lines 1 and 2. To meet maximum daily flow requirements, Alternative 2 would collect 600 gpm of potable water and 900 gpm of nonpotable water. Approximately 663 gpm of riparian would be released from the collection system at Texas Springs and Travertine Springs Lines 1 and 2 to restore riparian flow downstream of the springs. (see table II-1).[4] Average daily flow requirements are shown in table II-2.

Travertine Springs

This alternative would use all water from Travertine Springs Line 3 and Line 4 for potable water. Alternative 2 would require reconstruction of Lines 3 and 4 at Travertine Springs for potable water use. Reconstruction of the spring boxes would likely improve the water collection capabilities at Lines 3 and 4, and may result in slightly increased flows from these spring sources. Spring reconstruction would require the spring areas to be cleared and grubbed. The existing man-made materials over the springs would be removed, and the spring collection boxes would be reconstructed. The National Park Service would maintain the area above the Travertine Springs Line 3 and Line 4 spring surfaces to be kept clear of all vegetation to avoid contamination of the water source.

The spring collection boxes would be rebuilt by excavating the spring area to several feet below the water level. The area would then be backfilled with a geotextile fabric, a foot of clean gravel, perforated pipe, and several more feet of clean gravel to an elevation above the static water level. Two impermeable layers would be built on top of the rock gallery consisting of an impermeable geotextile membrane overlain by clay.

Travertine Springs Line 1 and Line 2 would be released to the surrounding environment using the methods described in the Riparian Water Releases section, above.

Texas Springs

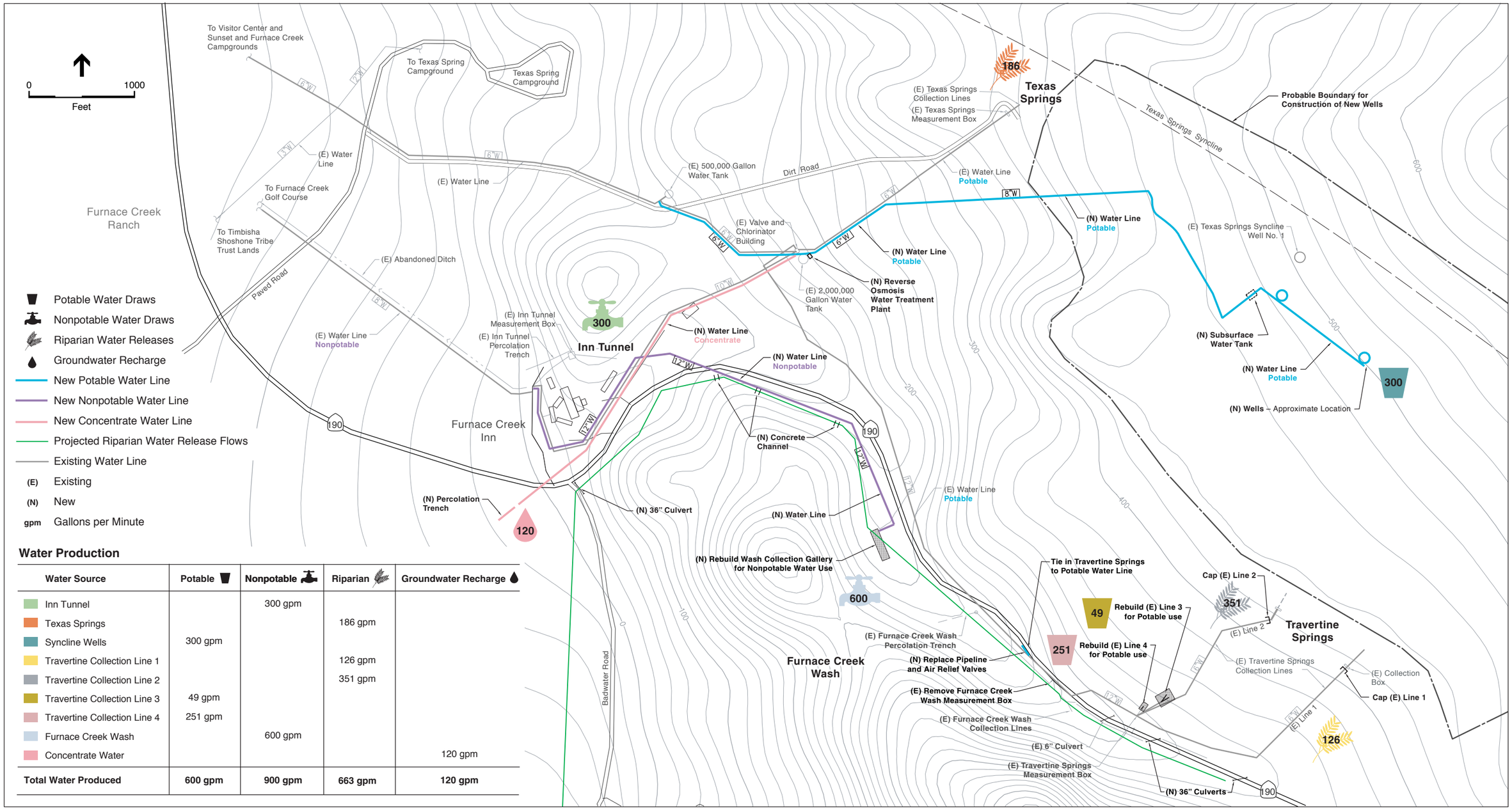
All water from Texas Springs would be released to the surrounding environment using the methods described in the Riparian Water Releases section, above.

Groundwater Production Wells

The National Park Service would drill two wells in the Texas Spring Syncline. The wells would have an estimated total production capacity of 300 gpm for potable water use to meet maximum daily flow requirements. One well would be for production purposes, and one well would be a back-up well. The wells would be drilled to a depth of up to 500 feet. Each well would include a 15-horsepower pump, an approximately 4-foot by 4-foot concrete pad for the well head, and an

4 Flow rates and water usage identified under each alternative associated with water draws from Travertine and Texas Springs, Furnace Creek Wash, the Inn Tunnel, and the proposed groundwater production wells (under Alternatives 2 and 3) would be approximate. These flow rates would be used for water collection system design purposes, and actual flows may vary slightly.

Figure II-3
Alternative 2

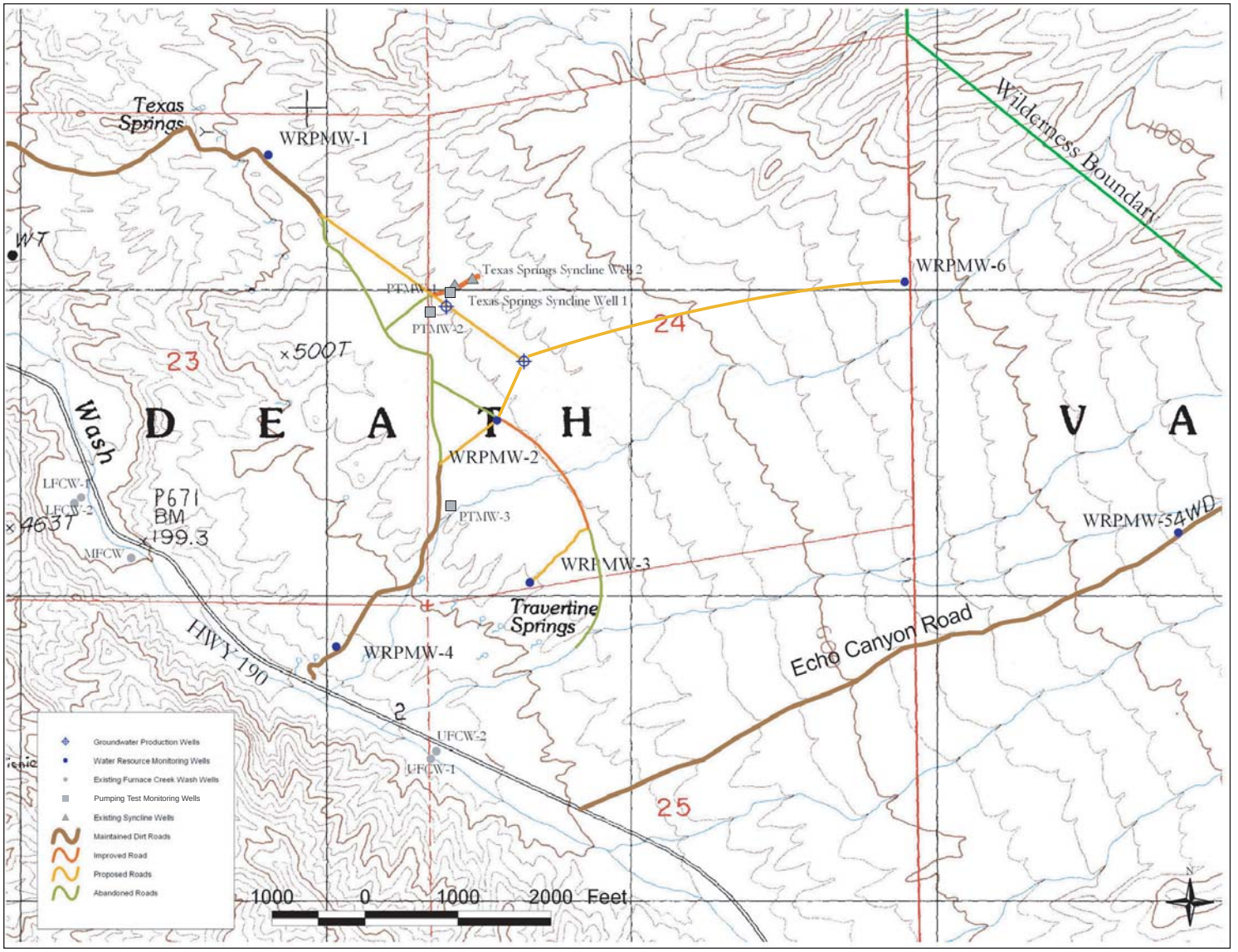


Water Production

Water Source	Potable	Nonpotable	Riparian	Groundwater Recharge
Inn Tunnel		300 gpm		
Texas Springs			186 gpm	
Syncline Wells	300 gpm			
Travertine Collection Line 1			126 gpm	
Travertine Collection Line 2			351 gpm	
Travertine Collection Line 3	49 gpm			
Travertine Collection Line 4	251 gpm			
Furnace Creek Wash		600 gpm		
Concentrate Water				120 gpm
Total Water Produced	**600 gpm**	**900 gpm**	**663 gpm**	**120 gpm**

SOURCE: Psomas and Environmental Science Associates

Figure II-4
Alternative 2



SOURCE: National Park Service and Environmental Science Associates

approximately 10-foot by 10-foot pump house to protect the well's electrical equipment. As shown in table II-2, on average 129 gpm (depending upon riparian water release needs of Travertine Springs) would be pumped under Alternative 2 to meet average daily flow requirements.[5]

The groundwater well system would include an approximately 5,600-linear-foot pipeline along a previously undisturbed route to transport the potable water to an existing water supply pipeline. A 3,000-gallon underground regulating storage tank also would be installed along this pipeline to allow groundwater pumped from the wells to flow via gravity into the reverse osmosis water treatment plant. Installation of the underground regulating storage tank would require excavation of a 10-foot deep by 40-foot wide area. Approximately 2,500-linear-foot of the existing 6-inch potable water supply pipeline to the 2-million and 500,000 gallon water storage tanks would be replaced due to the poor condition of the pipeline (see figure II-3). The well and pipeline system would require the development of a maintenance road to access the facilities, as shown on figure II-4. Electrical lines to service the wells would be routed in the same utility trenches as the proposed water lines.

The exact locations of the proposed groundwater production wells are not known at this time. Approximate well locations are shown in figures II-3 and II-4. The proposed groundwater wells would be located within the polygon area shown in figure II-3.

The exact effects of groundwater pumping are unknown at this time; however, discharges from spring outlets would be expected to decline as the groundwater flow system reaches a new equilibrium. Computer modeling of the Texas Springs Syncline aquifer indicates that the overall reduction in flow from the Travertine and Texas Springs system would be expected to equal the volume of groundwater pumped in order to meet average potable demand (Bredehoeft et al 2005).[6] The response to groundwater pumping would likely not occur immediately at the springs, as the National Park Service expects a time lag between the initiation of groundwater pumping and the effects observed at the springs and other discharge points. The length of the time lag could range from months to years and would depend upon the pumping rate and subsurface hydrogeologic conditions, which are not fully characterized. Full impacts of pumping may not be observed for 10 to 20 years after pumping begins. Due to the hydrogeologic conditions of the area, it would be likely that the effects would be spread reasonably evenly throughout discharge points in the Furnace Creek area. However, there may be some variation in the effects at individual discharge points because of local differences in aquifer hydraulic properties and the distance of the discharge points from the groundwater pumping wells.

Despite the uncertainty regarding reduction in flow at any specific discharge point, based on modeling of the system the National Park Service believes that the hydrogeology of the Furnace Creek area is sufficiently homogenous that assumptions can be made regarding the effects of groundwater pumping on spring flow. Therefore, the average daily flow requirements may

5 129 gpm of water from groundwater production wells would be supplemented with 300 gpm of water supplied from Travertine Springs to produce a total of 429 gpm of raw water. This volume of raw water would be needed to produce and meet average daily demand of 343 gpm of treated, potable water.

6 In 2005, data collected during a 72-hour groundwater pumping test indicated that continual extraction of groundwater at approximately 450 gpm would result in approximately 19 feet of drawdown in the Texas Springs Syncline aquifer. The hydrologic properties of the aquifer, such as direction and rate of groundwater flow, were also calculated using data from the 2005 test; computer modeling of the Texas Springs Syncline aquifer confirmed the hypothesis that pumping of groundwater would eventually affect discharge of springs in the Furnace Creek area (Bredehoeft et al 2005).

decrease discharges from spring outlets as discussed below. If the characteristics of the Texas Springs Syncline aquifer and the effects of pumping on springs are substantially different than anticipated by the National Park Service, the groundwater pumping plan would be modified. Potential modifications would rely upon data from the groundwater monitoring well network in Furnace Creek, field observations during groundwater production well installation, results of historic groundwater pumping tests, and monitoring of spring discharge following the initiation of groundwater pumping to evaluate response of the aquifer to stress from groundwater withdrawal in the Texas Springs Syncline. In order to minimize the effect of groundwater pumping on spring discharge, optimizing extraction rates among the proposed groundwater production wells may include refinement of the groundwater pumping schedule or altering the volume of water pumped from individual wells.

Based on an average water usage rate of 343 gpm of potable water (requiring 429 gpm of raw water with approximately 129 gpm supplied by groundwater wells) and computer modeling of the Texas Springs Syncline aquifer, the National Park Service estimates that discharges from the spring system may decrease an average of approximately 7% under Alternative 2 (NPS 2004c,d).[7] Flows from Travertine Springs Line 1 and Line 2 would be reduced to 126 gpm and 351 gpm, respectively. Flows from Texas Spring would be reduced to 186 gpm. Reconstruction of the Travertine Springs Line 3 and Line 4 spring boxes would likely improve the water collection capabilities at these springs, and therefore the spring output at these sources would not be reduced by 7%.

Groundwater pumping from production wells in the Texas Springs Syncline would not be anticipated to reduce flows from the Inn Tunnel or Furnace Creek Wash collection systems by 7% as these systems draw upon groundwater flowing in the alluvium of Furnace Creek Wash. Groundwater availability in Furnace Creek Wash would be affected by a decrease in flow from Travertine Springs due to groundwater pumping from the syncline; however, net groundwater flows in Furnace Creek Wash would be enhanced by increased riparian releases at Travertine Springs Line 2. In addition, reconstruction of the Furnace Creek Wash collection gallery would improve the water collection capabilities.

The increased groundwater pumping needed to meet maximum daily flow requirements (i.e., 300 gpm vs. 129 gpm from production wells) would not substantially reduce discharge from the spring outlets due to the short-term and episodic nature of these flow requirements. A temporary reduction of spring discharge, due to pumping to meet maximum daily demand requirements could occur in addition to the reduction caused by the average pumping rate; however, it is anticipated that the effects from maximum daily demand pumping would be dampened and attenuated by the time those stresses would be observed in spring discharge. The National Park Service would select a pumping schedule that would minimize fluctuations in water levels (i.e., use a low pumping rate over a longer period of time rather than a high pumping rate over a shorter period of time) when feasible.

Groundwater Monitoring Wells

The National Park Service would construct six wells in the Furnace Creek area to use in conjunction with existing wells, as described under the Elements Common to All Action

7 It is estimated that an average of 129 gpm would be pumped from the proposed groundwater wells under this alternative, which would be approximately 7% of total flow (i.e., 1,812 gpm) discharged or collected from the Furnace Creek system under the No Action Alternative.

Alternatives, for long-term monitoring of groundwater levels. The monitoring wells would assist the National Park Service in water resource protection and management by (1) establishing baseline groundwater levels and identifying future trends in groundwater levels, (2) evaluating response of the aquifer to stress from groundwater pumping in the Texas Springs Syncline, (3) defining the water balance for the Furnace Creek area, and (4) predicting the effect changes in groundwater levels may have on springs in the Furnace Creek area. The monitoring wells would be drilled as 6- to 8-inch diameter bores and completed with 2- or 4-inch diameter well casings. Drilling depths would most likely range between 50 and 400 feet. The locations of proposed groundwater monitoring wells are shown on figure II-4 and labeled as Water Resource Monitoring Wells.

Maintenance Roads

In order to access the proposed groundwater production wells and groundwater monitoring wells, the National Park Service would modify the maintenance road system in the project area. Under Alternative 2, the National Park Service would develop approximately 9,300 linear feet of new maintenance roads, and would improve approximately 1,400 linear feet of existing maintenance roads (see figure II-4). The National Park Service would develop the proposed and improved roads by grading the maintenance road path with a bulldozer. The maintenance roads would not be paved with asphalt.

Furnace Creek Wash Collection Gallery

The Furnace Creek Wash collection gallery would be removed from its existing location adjacent to Highway 190, and would be relocated approximately 2,000 feet northwest to the lower end of Furnace Creek Wash (see figure II-3). The Furnace Creek Wash collection gallery would be rebuilt approximately 300 feet (if possible) from Highway 190 to avoid damage to the collection gallery in the event of a motor vehicle accident along this segment of Highway 190.

The Furnace Creek Wash collection gallery would consist of 4 collection pipes, each about 50 feet in length and approximately 10 feet apart, disturbing an approximately 100-foot by 200-foot area. The 4 approximately 12-inch perforated collection pipes would be installed at a depth of approximately 25 feet beneath the surface. The trenches would be backfilled with on-site native materials. Reconstruction of the Furnace Creek Wash collection gallery would improve the water collection capabilities of the wash, and would result in increased flows from the gallery. Maximum daily flow requirements for Furnace Creek Wash are shown in table II-1 and average daily flow requirements are shown in table II-2.

Nonpotable water from the Furnace Creek Wash collection gallery would tie into an existing 8-inch nonpotable water line west of the Inn Tunnel via an approximately 5,400-linear-foot nonpotable water line. A portion of this nonpotable water line would replace the existing 10-inch pipeline between the 2-million gallon tank to the Inn Tunnel which has deteriorated due its age (see figure II-3).

An approximately five-foot long section of pipe in the vicinity of the existing Furnace Creek Wash measurement box would be replaced to correct high spots in the pipe alignment and repair malfunctioning air relief valves (see figure II-3).

Water Treatment

Under Alternative 2, the reverse osmosis water treatment plant would blend treated water with untreated bypass water at the water treatment plant. The bypass water would intentionally have a higher TDS level to avoid excessive pipe corrosion. The untreated bypass water would be safe potable water from a public health perspective, because its water source would not be under the influence of surface water and blending with treated water would dilute arsenic and fluoride concentrations in the blended water to meet federal and state drinking water standards.

Under Alternative 2, the 20% concentrate water output flow from the reverse osmosis water treatment plant would be transported to Furnace Creek Fan and discharged into a percolation trench for groundwater recharge. The concentrate water would be conveyed through 3,700-linear feet of 4-inch diameter pipeline that would be installed along a previously disturbed and undisturbed route (see figure II-3). Installation of the percolation trench in Furnace Creek Fan would disturb an area approximately 20 feet wide by 200 feet in length, and up to 10 feet in depth.

Under average daily flow requirements, approximately 86 gpm of concentrate water would be discharged through percolation to groundwater in Furnace Creek Fan. This discharge volume would increase during maximum daily flow requirement periods to 120 gpm. The concentrate water discharged through groundwater percolation would contain higher levels of dissolved minerals (such as arsenic, fluoride, and boron) and TDS than naturally occurring groundwater in the Furnace Creek area. Groundwater recharge and enhancement of subsurface flows in Furnace Creek Fan through percolation of concentrate water discharge flows under Alternative 2 could provide a water source for the mesquite bosque located near the Timbisha Shoshone Indian reservation.

Riparian-Wetland Restoration

Alternative 2 would release approximately 663 gpm from Travertine Springs Line 1 and Line 2 and Texas Springs for riparian and wetland restoration purposes. The exact effects of groundwater pumping upgradient of Travertine and Texas Springs on spring discharges are unknown at this time. Computer modeling of the Texas Springs Syncline aquifer indicates that groundwater pumping could decrease discharges from the spring system resulting in reductions of riparian water releases. The National Park Service estimates that spring discharges may decrease by approximately 7% as a result of groundwater pumping under Alternative 2 (see the Groundwater Production Wells section, above).

Using the measures described under the Riparian Water Releases section, above, the National Park Service would ensure that the riparian water releases would beneficially improve park resources through the reestablishment of historic wetland and riparian areas in the Travertine and Texas Springs areas. Groundwater recharge and subsurface flows in Furnace Creek Wash could provide a water source for the mesquite bosque located near the Timbisha Shoshone Indian reservation.

Culverts

Two culverts would be installed under Highway 190 in the vicinity of Travertine Springs to convey spring water from Travertine Springs Lines 1 and 2 under the highway. Each culvert would be approximately 36 inches in diameter, and would be sufficiently sized to convey flood flows. The proposed culvert located near the existing Travertine Springs measurement box would

replace the existing 24-inch culvert. In addition, a 36-inch culvert would be installed at Badwater Road to convey riparian flows to Furnace Creek Fan. All culverts would be installed using open trench construction techniques.

Construction

Alternative 2 construction activity would occur over a 12-month period from approximately spring 2007 through spring 2008. In Death Valley National Park, construction activity during the summer months (i.e., June through August) is infeasible due to the heat. During winter months, construction would occur between 7:00 am and 5:00 pm. During spring and fall months, construction would occur from dawn to 4:00 pm.

Construction equipment would include a backhoe, bulldozer, well drilling rig, pump truck, compactor, excavator, loader, dump truck, water truck, pick-up truck, generator, jackhammer, bypass pump, bore-and-jack machine, crane, grader, and concrete truck.

Alternative 2 construction activity would generate an average of approximately 10 external truck trips per day (about 2,400 external truck trips), and approximately 15 internal truck trips per day (about 3,600 internal truck trips).[8] Alternative 2 would generate a total of approximately 6,000 truck trips.

An average of 10 full-time equivalent workers would be on-site at any given time during the construction period.

An area of Furnace Creek Campground that is not currently used by park visitors would serve as the construction staging area. Furnace Creek Campground is located near park headquarters and the Furnace Creek Visitor Center, approximately one-mile from the work area. Construction workers would be housed in trailers at the Cow Creek Recreational Vehicle Salt Pan Vista near the construction staging area.

Cost Estimate

The preliminary cost estimate for Alternative 2 is approximately $4.6 million dollars, including $2.1 million in operation and maintenance costs[9] and $2.5 million in capital costs (Psomas 2004, 2005).

Alternative 3 (Preferred)

Alternative 3 would provide potable water from two to three groundwater production wells located in the Texas Spring Syncline (see figures II-5 and II-6). Nonpotable water would be collected from Furnace Creek Wash and the Inn Tunnel. Water for riparian restoration purposes would be released from Texas Springs and Travertine Springs Lines 1, 2, 3, and 4. To meet maximum daily flow requirements, Alternative 3 would collect 600 gpm of potable water and 900

8 Internal truck trips do not require travel outside Death Valley National Park, while external truck trips are those which require trucks to enter and exit Death Valley National Park in order to transport supplies, etc.

9 Operation and maintenance costs for all action alternatives are projected as a 20-year present worth with an inflation rate of 2.5% and an interest rate of 7.0%.

gpm of nonpotable water, and release approximately 770 gpm of riparian water (see table II-1).[10] Average daily flow requirements are shown in table II-2.

Travertine Springs

This alternative would release all water from Travertine Springs Lines 1, 2, 3, and 4 for riparian restoration purposes. Travertine Springs would be released to the surrounding environment using the methods described in the Riparian Water Releases section, above.

Texas Springs

All water from Texas Springs would be released to the surrounding environment using the methods described in the Riparian Water Releases section, above.

Groundwater Production Wells

The National Park Service would drill two to three wells in the Texas Spring Syncline. The wells would have an estimated total production capacity of approximately 600 gpm for potable water use to meet maximum daily flow requirements. Two of the wells would be for production purposes (300 gpm each), and one well would serve as a back-up well. The wells would be drilled to a depth of up to 500 feet. Each well would include a 15-horsepower pump, an approximately 4-foot by 4-foot concrete pad for the well head, and an approximately 10-foot by 10-foot pump house to protect the well's electrical equipment. As shown in table II-2, approximately 429 gpm would be pumped under Alternative 3 to meet average daily flow requirements.[11] When pumping at an average rate of 429 gpm, the National Park Service would likely pump from groundwater production wells located farthest from Travertine Springs Lines 1 and 2.

The groundwater well system also would include an approximately 6,600-linear-foot pipeline along a previously undisturbed route to transport the potable water to an existing water supply pipeline. A 3,000-gallon underground regulating storage tank would also be installed along this pipeline in order that would allow groundwater pumped from the wells to flow via gravity into the reverse osmosis water treatment plant. Installation of the tank would require excavation of a 10-foot deep by 40-foot wide area. Approximately 2,500-linear foot of the existing potable water pipeline to the 2-million and 500,000 gallon water storage tanks would be replaced due to the poor condition of the pipeline (see figure II-5). The well and pipeline system would require the development of a maintenance road to access the facilities as shown on figure II-6. Electrical lines to service the wells would be routed in the same utility trenches as the proposed water lines.

The exact locations of the proposed groundwater production wells are not known at this time. Approximate well locations are shown in figures II-5 and II-6. The proposed groundwater wells would be located within the polygon area shown in figure II-5.

The exact effects of groundwater pumping are unknown at this time; however, discharges from spring outlets are expected to decline as the groundwater system reaches a new equilibrium.

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10 Flow rates and water usage identified under each alternative associated with water draws from Travertine and Texas Springs, Furnace Creek Wash, the Inn Tunnel, and the proposed groundwater production wells (under Alternatives 2 and 3) would be approximate. These flow rates would be used for water collection system design purposes, and actual flows may vary slightly.

11 429 gpm of raw water would be needed to produce and meet the average daily demand of 343 gpm treated, potable water.

Computer modeling of the Texas Springs Syncline aquifer indicates that the overall reduction in flow from the Travertine and Texas Springs system would be expected to equal the volume of groundwater pumped to meet average daily demand (Bredehoeft et al 2005).[12] The response to groundwater pumping would likely not occur immediately at the springs, as the National Park Service expects a time lag between the initiation of groundwater pumping and the effects observed at the springs and other discharge points. The length of the time lag could range from months to years and would depend upon the pumping rate and subsurface hydrogeologic conditions, which are not fully characterized. Full impacts of groundwater pumping may not be observed for 10 to 20 years after pumping begins. Similar to Alternative 2, due to the geohydrologic conditions of the area, it would be likely that the effects would be spread reasonably evenly throughout discharge points in the Furnace Creek area; however, there may be some variation in the effect at individual discharge points because of local differences in aquifer properties and the distance of the discharge points from the groundwater pumping wells.

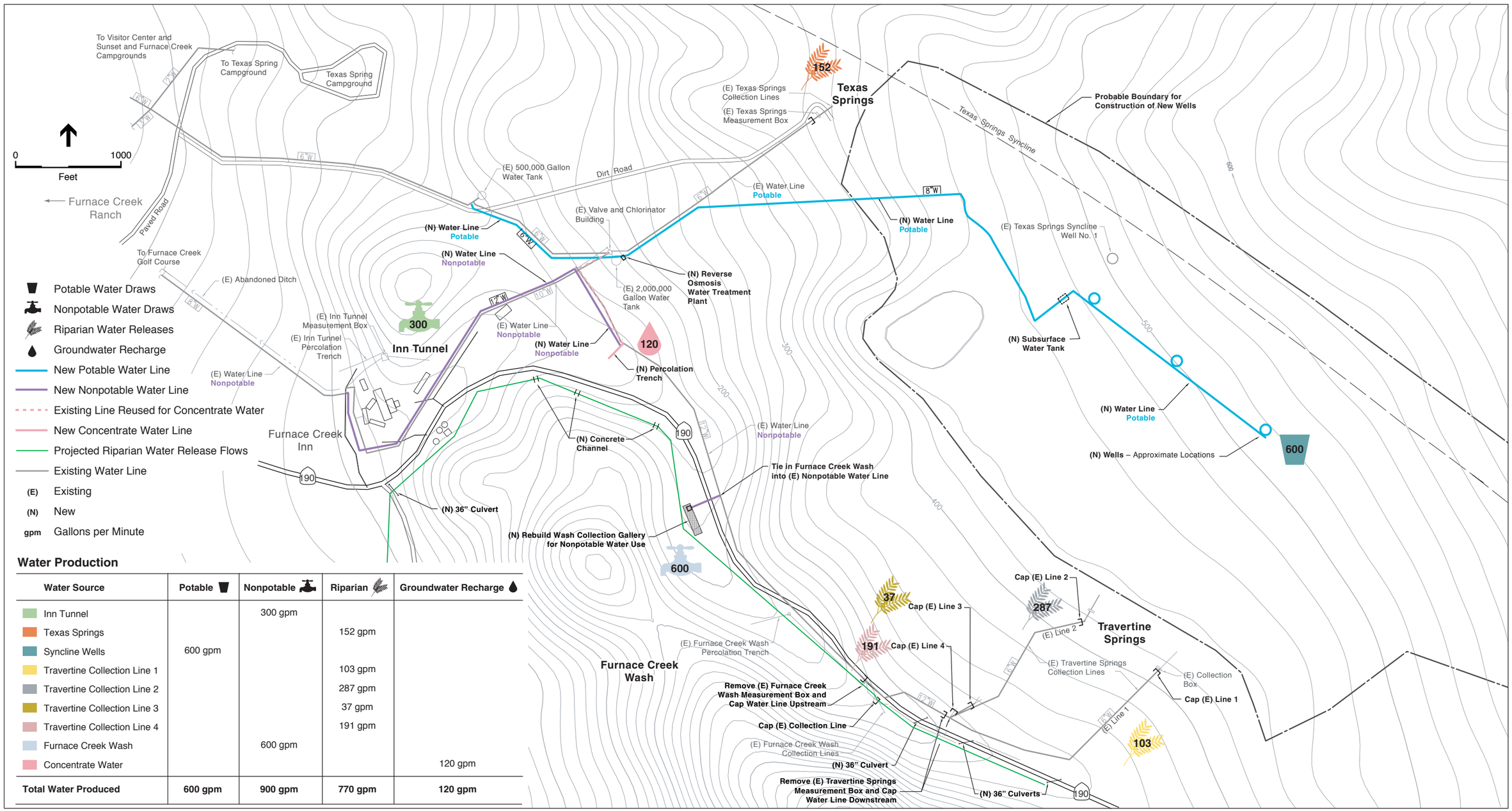
Despite the uncertainty regarding reduction in flow at any specific discharge point based on modeling of the system, the National Park Service believes that the hydrogeology of the Furnace Creek area is sufficiently homogenous that assumptions can be made regarding the effects of groundwater pumping on spring flow. Therefore, the average daily flow requirements may decrease discharges from spring outlets as discussed below. If the characteristics of the Texas Springs Syncline aquifer and the effects of pumping on springs are substantially different than anticipated by the National Park Service, the groundwater pumping plan would be modified. Potential modifications would rely upon data from the groundwater monitoring well network in Furnace Creek, field observations during groundwater production well installation, results of historic groundwater pumping tests, and monitoring of spring discharge following the initiation of groundwater pumping to evaluate response of the aquifer to stress from groundwater withdrawal in the Texas Springs Syncline. In order to minimize the effect of groundwater pumping on spring discharge, optimizing extraction rates among the proposed groundwater production wells may include refinement of the groundwater pumping schedule or altering the volume of water pumped from individual wells.

Based on an average water usage rate of 343 gpm of potable water (requiring 429 gpm of raw water with 100% of potable water supplied by groundwater wells) and computer modeling of the Texas Springs Syncline aquifer, the National Park Service estimates that discharges from the spring system may decrease an average of approximately 24% under Alternative 3 (NPS 2004c,d).[13] Flows from Travertine Springs Line 1, Line 2, Line 3, and Line 4 would be reduced to 103 gpm, 287 gpm, 37 gpm, and 191 gpm, respectively. Flows from Texas Spring would be reduced to 152 gpm.

12 In 2005, data collected during a 72-hour groundwater pumping test indicated that continual extraction of groundwater at approximately 450 gpm would result in approximately 19 feet of drawdown in the Texas Springs Syncline aquifer. The hydrologic properties of the aquifer, such as direction and rate of groundwater flow, were also calculated using data from the 2005 test; computer modeling of the Texas Springs Syncline aquifer confirmed the hypothesis that pumping of groundwater would eventually affect discharge of springs in the Furnace Creek area (Bredehoeft et al 2005).

13 It is estimated that an average of 429 gpm would be pumped from the proposed groundwater wells under this alternative, which would be approximately 24% of total flow (i.e., 1,812 gpm) discharged or collected from the Furnace Creek system under the No Action Alternative.

Figure II-5
Alternative 3 (Preferred)

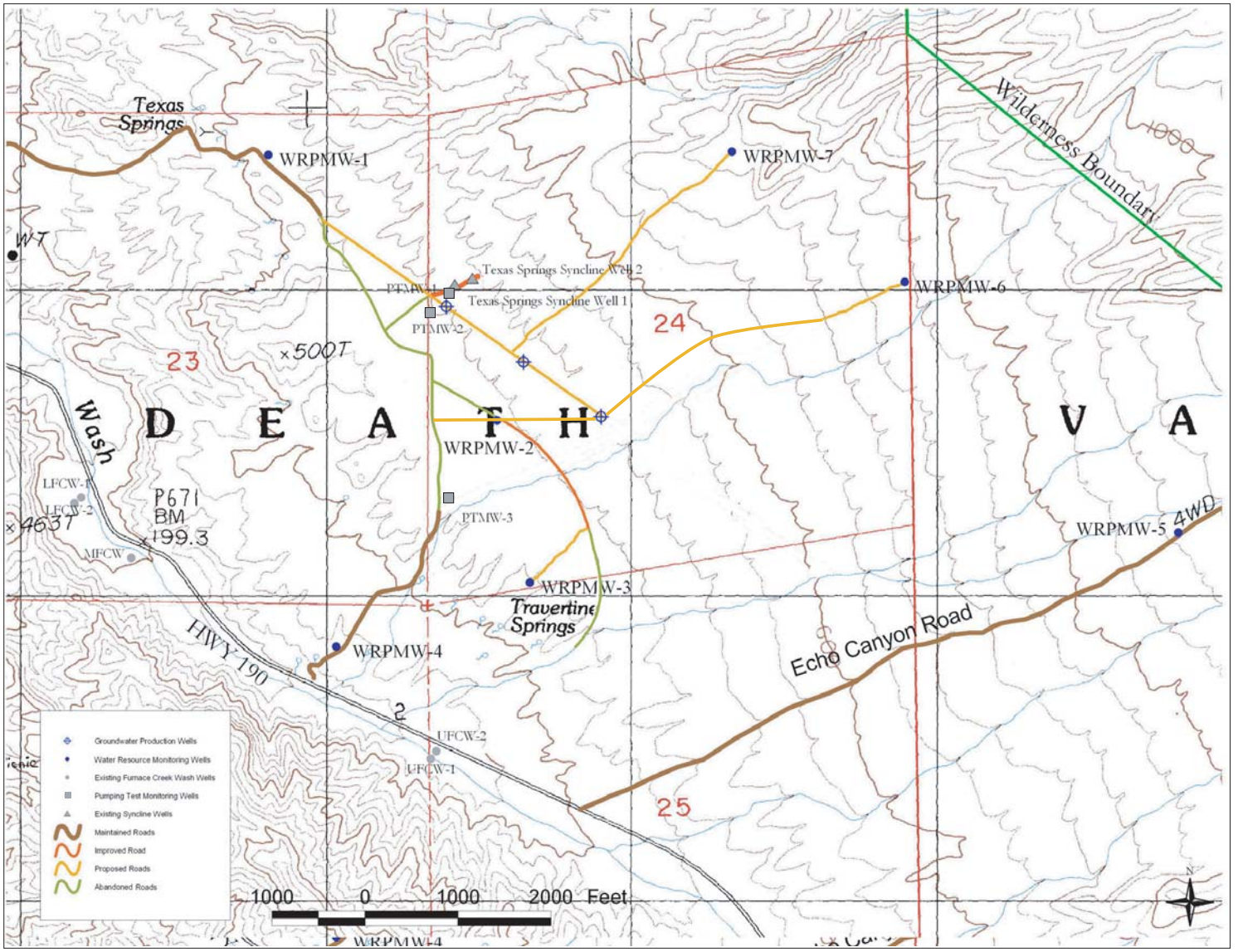


Water Production

Water Source	Potable	Nonpotable	Riparian	Groundwater Recharge
Inn Tunnel		300 gpm		
Texas Springs			152 gpm	
Syncline Wells	600 gpm			
Travertine Collection Line 1			103 gpm	
Travertine Collection Line 2			287 gpm	
Travertine Collection Line 3			37 gpm	
Travertine Collection Line 4			191 gpm	
Furnace Creek Wash		600 gpm		
Concentrate Water				120 gpm
Total Water Produced	**600 gpm**	**900 gpm**	**770 gpm**	**120 gpm**

SOURCE: Psomas and Environmental Science Associates

Figure II-6
Alternative 3 (Preferred)



SOURCE: National Park Service and Environmental Science Associates

Groundwater pumping from production wells in the Texas Springs Syncline would not be anticipated to reduce flows from the Inn Tunnel or Furnace Creek Wash collection systems by 24% as these systems draw upon groundwater flowing in the alluvium of Furnace Creek Wash. Groundwater availability in Furnace Creek Wash would be affected by a decrease in flow from Travertine Springs due to groundwater pumping from the syncline; however, net groundwater flows in Furnace Creek Wash would be enhanced by increased riparian releases from Travertine Springs Lines 2, 3, and 4. In addition, reconstruction of the Furnace Creek Wash collection gallery would improve the water collection capabilities.

The increased groundwater pumping needed to meet maximum daily flow requirements (i.e., 600 gpm vs. 429 gpm from production wells) would not substantially affect discharge from the spring outlets due to the short-term and episodic nature of these well pumping requirements. A temporary reduction of spring discharge, due to pumping to meet maximum daily demand requirements could occur in addition to the reduction caused by the average pumping rate; however, it is anticipated that the effects from maximum daily demand pumping would be dampened and attenuated by the time those stresses are observed in spring discharge. The National Park Service would select a pumping schedule that would minimize fluctuations in water levels (i.e., use a low pumping rate over a longer period of time rather than a high pumping rate over a shorter period of time) when feasible.

Groundwater Monitoring Wells

The National Park Service would construct seven wells in the Furnace Creek area to use in conjunction with existing wells, as described under the Elements Common to All Action Alternatives, for long-term monitoring of groundwater levels. The monitoring wells would assist the National Park Service in water resource protection and management by (1) establishing baseline groundwater levels and identifying future trends in groundwater levels, (2) evaluating response of the aquifer to stress from groundwater pumping in the Texas Springs Syncline, (3) defining the water balance for the Furnace Creek area, and (4) predicting the effect changes in groundwater levels may have on springs in the Furnace Creek area. The monitoring wells would be drilled as 6- to 8-inch diameter bores and completed with 2- or 4-inch diameter well casings. Drilling depths would most likely range between 50 and 400 feet. The locations of proposed groundwater monitoring wells are shown on figure II-6 labeled as Water Resource Monitoring Wells.

Maintenance Roads

In order to access the proposed groundwater production wells and groundwater monitoring wells, the National Park Service would modify the maintenance road system in the project area. Under Alternative 3, the National Park Service would develop approximately 13,800 linear feet of new maintenance roads, and would improve approximately 1,400 linear feet of existing maintenance roads (see figure II-6). The National Park Service would develop the proposed and improved roads by grading the maintenance road path with a bulldozer. The maintenance roads would not be paved with asphalt.

Furnace Creek Wash Collection Gallery

As described under Alternative 2, the Furnace Creek Wash collection gallery would be removed from its existing location adjacent to Highway 190 and would be relocated approximately

2,000 feet northwest to the lower end of Furnace Creek Wash (see figure II-5). The Furnace Creek Wash collection gallery would be rebuilt approximately 300 feet (if possible) from Highway 190 to avoid damage to the collection gallery in the event of a motor vehicle accident along this segment of Highway 190. Reconstruction of the Furnace Creek Wash collection gallery would improve the water collection capabilities of the wash, and would result in increased flows from the gallery. Maximum daily flow requirements for Furnace Creek Wash are shown in table II-1 and average daily flow requirements are shown in table II-2.

Nonpotable water from the Furnace Creek Wash collection gallery would tie into the existing 12-inch nonpotable water pipeline east of Highway 190, and subsequently tie into a new 12-inch nonpotable water line in order to replace the existing pipeline which has deteriorated due to its age (see figure II-5). Overall, approximately 4,500 linear feet of newly installed nonpotable water lines would be constructed under Alternative 3.

Water Treatment

Blending of treated and untreated bypass water at the reverse osmosis water treatment plant under Alternative 3 would be the same as described under Alternative 2. Under Alternative 3, the 20% concentrate water output flow from the reverse osmosis water treatment plant would be transported to Furnace Creek Wash and discharged into a percolation trench for groundwater recharge. The concentrate water would be conveyed to the wash through existing 10-inch and 12-inch water lines (see figure II-5). Installation of the percolation trench in Furnace Creek Wash would disturb an area approximately 20 feet wide by 200 feet in length, and up to 10 feet in depth. Under average daily flow requirements, approximately 86 gpm of concentrate water would be discharged to groundwater. This discharge volume would increase during maximum daily flow requirement periods to 120 gpm. The concentrate water discharged through groundwater percolation would contain higher levels of dissolved minerals (such as arsenic, fluoride, and boron) and TDS than naturally occurring groundwater in the Furnace Creek area. Groundwater recharge and enhancement of subsurface flows in Furnace Creek Wash through percolation of concentrate water discharge flows under Alternative 3 could provide a water source for the mesquite bosque located near the Timbisha Shoshone Indian reservation.

Riparian-Wetland Restoration

Alternative 3 would release approximately 770 gpm from Travertine Springs Lines 1, 2, 3, and 4 and Texas Springs for riparian and wetland restoration purposes. The exact effects of groundwater pumping upgradient of Travertine and Texas Springs on spring discharges are unknown at this time, and could somewhat decrease discharges from the spring system resulting in reductions in estimates of riparian water releases. The National Park Service estimates that spring discharges may decrease by approximately 24% as a result of groundwater pumping under Alternative 3 (see the Groundwater Production Wells section, above).

Using the measures described under the Riparian Water Releases section, above, the National Park Service would ensure that the riparian water releases would beneficially improve park resources through the reestablishment of historic wetland and riparian areas in the Travertine and Texas Springs areas. Groundwater recharge and subsurface flows in Furnace Creek Wash could provide a water source for the mesquite bosque located near the Timbisha Shoshone Indian reservation.

Culverts

Three culverts would be installed under Highway 190 in the vicinity of Travertine Springs to convey spring water from Travertine Springs Lines 1, 2, 3, and 4 under the highway. Each culvert would be approximately 36 inches in diameter, and would be sufficiently sized to convey flood flows. The proposed culvert located near the existing Travertine Springs measurement box would replace the existing 24-inch culvert. The culvert downslope from Travertine Springs Lines 3 and 4 would replace an existing 6-inch culvert at this location. In addition, a 36-inch culvert would be installed at Badwater Road to convey riparian flows to Furnace Creek Fan. All culverts would be installed using open trench construction techniques.

Construction

Construction activities under Alternative 3 would be the same as described under Alternative 2.

Cost Estimate

The preliminary cost estimate for Alternative 3 is approximately $4.7 million dollars, including $2.2 million in operation and maintenance costs[14] and $2.5 million in capital costs (Psomas 2004, 2005).

Alternative 4

Alternative 4 would develop a reverse osmosis water treatment plant with treated bypass water, which would provide the National Park Service with the flexibility to supply potable water from any of its existing water sources. Under this alternative, potable water would be supplied from Travertine Springs Lines 2, 3, and 4 and Texas Springs (see figure II-7). Under this water supply scenario, the National Park Service would draw water from the least resource-sensitive water sources first. The National Park Service would draw water from Travertine Springs Lines 3 and 4, then Texas Springs, then Travertine Springs Line 2. The agency may modify the volumes of potable water drawn from Texas Springs and Travertine Springs Line 2, as well as the other water sources, to ensure riparian and aquatic resources would not be adversely affected by water draws. Nonpotable water would be collected from Furnace Creek Wash and the Inn Tunnel. Water for riparian restoration purposes would be released from Texas Springs and Travertine Springs Lines 1 and 2. To meet maximum daily flow requirements, Alternative 4 would collect 600 gpm of potable water and 900 gpm of nonpotable water, and release approximately 412 gpm of riparian water (see table II-1).[15] Average daily flow requirements are shown in table II-2.

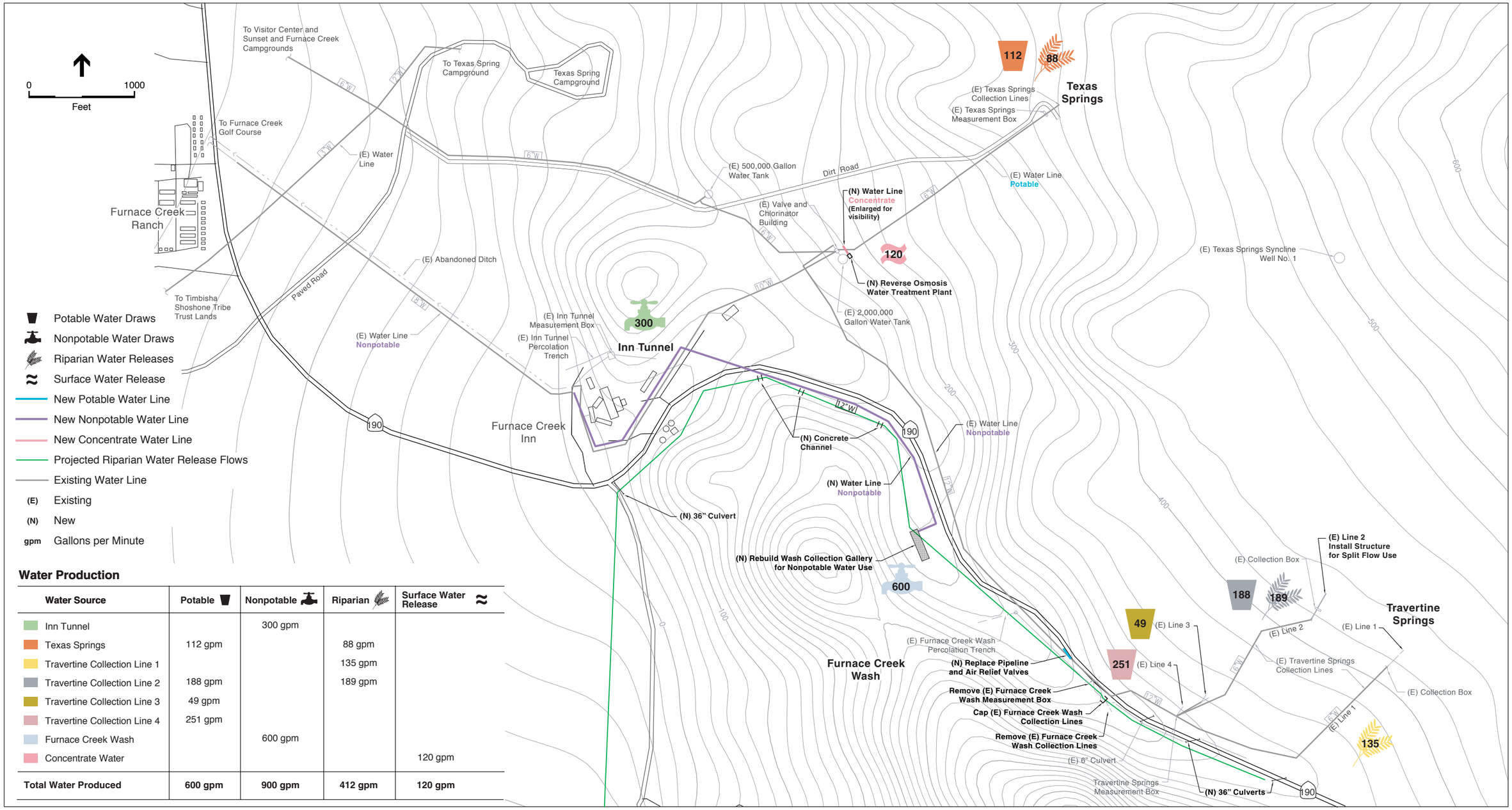
Travertine Springs

This alternative would use all water from Travertine Springs Lines 3 and 4 for potable purposes, and occasionally water from Travertine Springs Line 2. Since the National Park Service would treat all potable water under this alternative (including bypass water), Travertine Springs Lines 2, 3, and 4 would not require reconstruction of spring collection boxes or clearing and grubbing of

14 Operation and maintenance costs for all action alternatives are projected as a 20-year present worth with an inflation rate of 2.5% and an interest rate of 7.0%.

15 Flow rates and water usage identified under each alternative associated with water draws from Travertine and Texas Springs, Furnace Creek Wash, the Inn Tunnel, and the proposed groundwater production wells (under Alternatives 2 and 3) would be approximate. These flow rates would be used for water collection system design purposes, and actual flows may vary slightly.

Figure II-7
Alternative 4



Water Production

Water Source	Potable	Nonpotable	Riparian	Surface Water Release
Inn Tunnel		300 gpm		
Texas Springs	112 gpm		88 gpm	
Travertine Collection Line 1			135 gpm	
Travertine Collection Line 2	188 gpm		189 gpm	
Travertine Collection Line 3	49 gpm			
Travertine Collection Line 4	251 gpm			
Furnace Creek Wash		600 gpm		
Concentrate Water				120 gpm
Total Water Produced	**600 gpm**	**900 gpm**	**412 gpm**	**120 gpm**

SOURCE: Psomas and Environmental Science Associates

vegetation from the spring area. Such measures would be employed to ensure that potable water sources would not come under the influence of surface water contaminants.

Under maximum daily flow requirements, all of Travertine Springs Line 1 and 189 gpm of Line 2 (see table II-1) would be released to the surrounding environment using the methods described in the Riparian Water Releases section, above. Under average daily flow requirements, Travertine Springs Line 1 and Line 2 (see table II-2) would be released to the surrounding environment.

Texas Springs

This alternative would use a portion of the water from Texas Springs for potable water. Similar to Travertine Springs Lines 2, 3, and 4, Texas Springs would not require reconstruction of spring collection boxes or clearing and grubbing of vegetation from the spring area to allow use of the springs for potable water due to National Park Service plans to treat potable water (including bypass water) under Alternative 4.

Under maximum daily flow requirements, approximately 88 gpm from Texas Springs (see table II-1) would be released to the surrounding environment using the methods described in the Riparian Water Releases section, above. Similarly under average daily flow requirements, approximately 71 gpm of Texas Springs (see table II-2) would be released to the surrounding environment.

Groundwater Monitoring Wells

The National Park Service would construct four wells in the Furnace Creek area to use in conjunction with existing wells, as described under the Elements Common to All Action Alternatives, for long-term monitoring of groundwater levels. The monitoring wells would assist the National Park Service in water resource protection and management by (1) establishing baseline groundwater levels and identifying future trends in groundwater levels, (2) defining the water balance for the Furnace Creek area, and (3) predicting the effect changes in groundwater levels may have on springs in the Furnace Creek area. The monitoring wells would be drilled as 6- to 8-inch diameter bores and completed with 2- or 4-inch diameter well casings. Drilling depths would most likely range between 50 and 400 feet. The locations of proposed groundwater monitoring wells are shown on figure II-8 labeled as Water Resource Monitoring Wells.

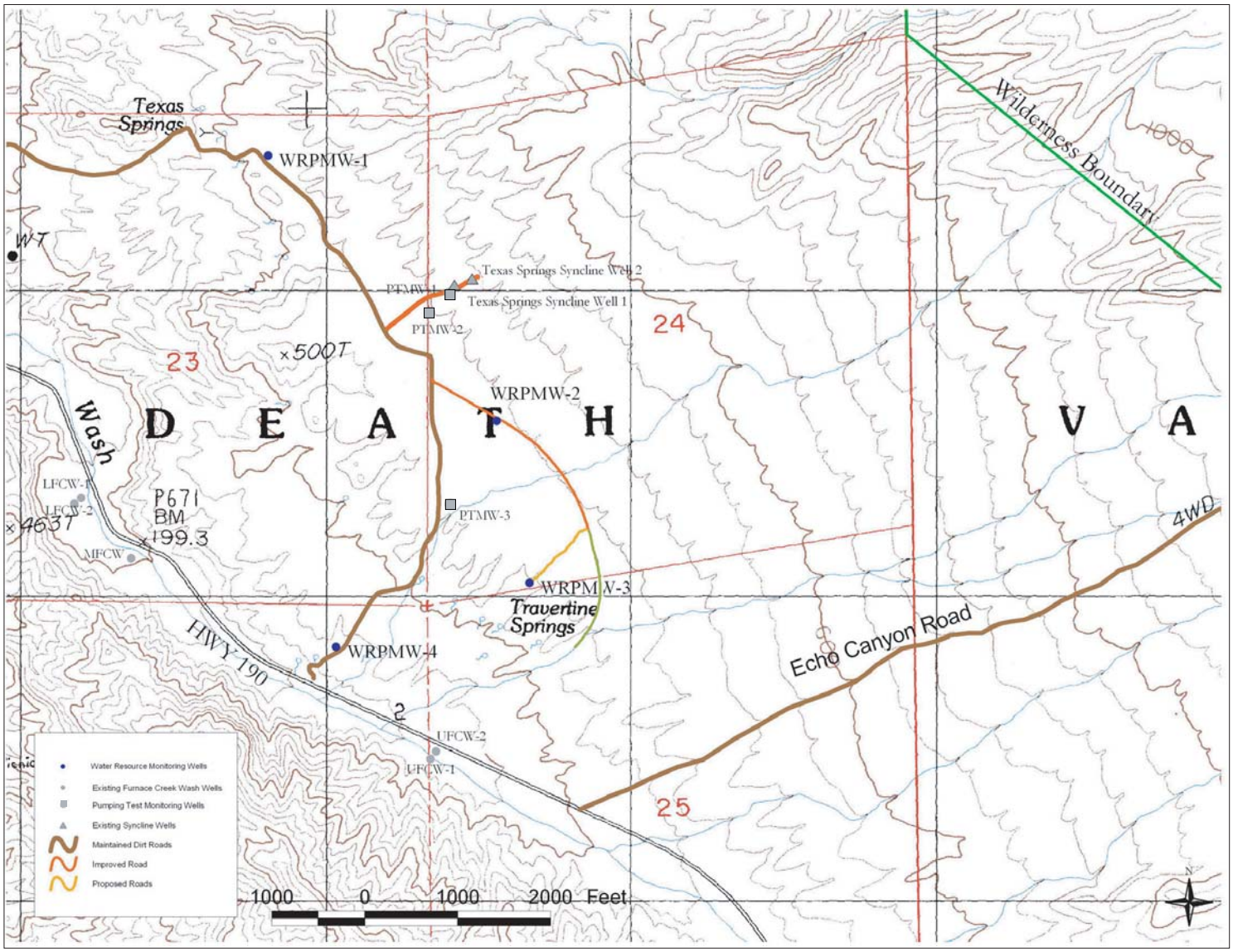
Maintenance Roads

In order to access the proposed groundwater monitoring wells, the National Park Service would modify the maintenance road system in the project area. Under Alternative 4, the National Park Service would develop approximately 1,100 linear feet of new maintenance roads, and would improve approximately 3,900 linear feet of existing maintenance roads (see figure II-8). The National Park Service would develop the proposed and improved roads by grading the maintenance road path with a bulldozer. The maintenance roads would not be paved with asphalt.

Furnace Creek Wash Collection Gallery

As described under Alternative 2, the Furnace Creek Wash collection gallery would be removed from its existing location adjacent to Highway 190, and would be relocated approximately 2,000 feet northwest to the lower end of Furnace Creek Wash (see figure II-7). The Furnace

Figure II-8
Alternative 4



SOURCE: National Park Service and Environmental Science Associates

Creek Wash collection gallery would be rebuilt approximately 300 feet (if possible) from Highway 190 to avoid damage to the collection gallery in the event of a motor vehicle accident along this segment of Highway 190. Reconstruction of the Furnace Creek Wash collection gallery would improve the water collection capabilities of the wash, and would result in increased flows from the gallery. Maximum daily flow requirements for Furnace Creek Wash are shown in table II-1 and average daily flow requirements are shown in table II-2.

Nonpotable water from the Furnace Creek Wash collection gallery would tie into an existing 8-inch nonpotable water line west of the Inn Tunnel via approximately 5,400 linear feet of newly installed nonpotable water lines. A portion of this nonpotable water line would replace the existing 10-inch pipeline between the 2-million gallon tank to the Inn Tunnel which has deteriorated due to its age (see figure II-7).

Similar to Alternative 2, an approximately five-foot long section of pipe in the vicinity of the existing Furnace Creek Wash measurement box would be replaced to correct high spots in the pipe alignment and repair malfunctioning air relief valves (see figure II-7).

Water Treatment

Under Alternative 4, treated water from the reverse osmosis water treatment plant would be blended with treated bypass water at the water treatment plant. The treated bypass water would intentionally have a higher TDS level to avoid excessive pipe corrosion. Treating the bypass water under Alternative 4 would provide the National Park Service with the flexibility to supply potable water from any of its existing water sources without needing to rebuild the spring boxes.

Concentrate water output volumes in Alternative 4 would be the same as described under Alternative 2. The 20% concentrate water output flow would be discharged through a newly installed 50-foot, 4-inch pipeline to a tributary of Texas Springs Wash located northwest of the proposed reverse osmosis water treatment plant. This wash transmits riparian water flows from upgradient spring sources and occasionally receives water discharged from the 2-million gallon tank; however, discharge from the 2-million gallon tank would be eliminated under Alternative 4. To meet average daily flow requirements, approximately 86 gpm of concentrate water would be discharged to Texas Springs Wash. This discharge volume would increase during maximum daily flow requirement periods to 120 gpm. The concentrate water discharged to Texas Springs Wash would contain higher levels of dissolved minerals (such as arsenic, fluoride, and boron) and TDS than naturally occurring water in the Furnace Creek area.

The National Park Service would use a general approach similar to that described in the Riparian Water Releases section for discharge of concentrate water to address energy dissipation, reduce evaporative losses, slow water surface flow velocity to promote infiltration back into the subsurface, and reduce erosion.

- Build narrow and shallow infiltration ditches downstream of the discharge outlet to provide the concentrate water with a preferential pathway for reinfiltration of unused water. The infiltration ditches would be approximately 6 inches to 1 foot deep. The trenches would be filled with permeable backfill, and may include drip systems or weep pipes. The infiltration ditches would be oriented downslope and cross-contour.
- Install temporary ground diffusion piping (for a season or two) to disperse concentrate water on the surface until soil moisture and riparian vegetation can reach a reasonable equilibrium.

- Place straw waddles (with weed-free straw) cross slope to avoid excessive erosion and runoff, and to assist in establishing a saturation zone to promote water infiltration.
- Plant additional native riparian vegetation to promote groundwater infiltration and reduce evaporative losses and erosion.

Riparian Wetland Restoration

Alternative 4 would release water from Travertine Springs Line 1 and Line 2 and Texas Springs for riparian and wetland restoration purposes. Under maximum daily flow requirements, approximately 412 gpm (see table II-1) would be released to the surrounding environment. Under average daily flow requirements, approximately 583 gpm (see table II-2) would be released to the surrounding environment. Using the measures described under the Riparian Water Releases section, above, the National Park Service would ensure that the riparian water releases would beneficially improve park resources through the reestablishment of historic wetland and riparian areas in the Travertine and Texas Springs areas. Groundwater recharge and subsurface flows in Furnace Creek Wash could provide a water source for the mesquite bosque located near the Timbisha Shoshone Indian reservation.

Culverts

Two culverts would be installed under Highway 190 in the vicinity of Travertine Springs to convey spring water from Travertine Springs Lines 1 and 2 under the highway. Each culvert would be approximately 36 inches in diameter, and would be sufficiently sized to convey flood flows. The proposed culvert located near the existing Travertine Springs measurement box would replace the existing 24-inch culvert. In addition, a 36-inch culvert would be installed at Badwater Road to convey riparian flows to Furnace Creek Fan. All culverts would be installed using open trench construction techniques.

Construction

Alternative 4 construction activity would occur over a 9-month period from approximately spring 2007 through winter 2008. In Death Valley National Park, construction activity during the summer months (i.e., June through August) is infeasible due to the heat. During winter months, construction would occur between 7:00 am and 5:00 pm. During spring and fall months, construction would occur from dawn to 4:00 pm.

Construction equipment would include a backhoe, bulldozer, compactor, excavator, loader, dump truck, water truck, pick-up truck, generator, jackhammer, bypass pump, bore-and-jack machine, crane, grader, and concrete truck.

Over the 9-month construction period, Alternative 4 construction activity would generate an average of approximately 10 external truck trips per day (about 1,800 external truck trips), and approximately 15 internal truck trips per day (about 2,700 internal truck trips). Alternative 4 would generate a total of approximately 4,500 truck trips.

An average of 10 full-time equivalent workers would be on-site at any given time during the construction period.

An area of Furnace Creek Campground that is not currently used by park visitors would serve as the construction staging area. Furnace Creek Campground is located near park headquarters and

the Furnace Creek Visitor Center, approximately one-mile from the work area. Construction workers would be housed in trailers at the Cow Creek Recreational Vehicle Salt Pan Vista near the construction staging area.

Cost Estimate

The preliminary cost estimate for Alternative 4 is approximately $3.7 million dollars, including $2.0 million in operation and maintenance costs[16] and $1.7 million in capital costs (Psomas 2004).

Environmentally Preferable Alternative

The Council on Environmental Quality Regulations implementing NEPA and the National Park Service NEPA guidelines require that "the alternative or alternatives which were considered to be environmentally preferable" be identified (Council on Environmental Quality Regulations, Section 1505.2). Environmentally preferable is defined as "the alternative that will promote the national environmental policy as expressed in the National Environmental Policy Act's Section 101. Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative that best protects, preserves, and enhances historic, cultural, and natural resources" (Council on Environmental Quality 1981).

Section 101 of NEPA states that "… it is the continuing responsibility of the Federal Government to … (1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations; (2) assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings; (3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences; (4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice; (5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and (6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources." The environmentally preferable alternative for the Reconstruction of the Furnace Creek Water Collection System is based on these national environmental policy goals.

The National Park Service considered the alternatives in this analysis in accordance with NEPA and Council on Environmental Quality regulations (Section 1505.2) and determined that Alternative 3 (Preferred) as presented in this environmental impact statement would be environmentally preferable based on its furtherance of the following NEPA goals as evaluated below.

- **NEPA Section 101 Requirement 1.** "Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations."

All of the action alternatives would equally fulfill this goal with respect to the provision of potable water that would meet federal and state drinking water standards for visitors, staff, and residents in the Furnace Creek area. Alternative 1 would not provide safe drinking water, and would not fulfill the purpose and need of the proposed action. With respect to water quality, Alternative 1

16 Operation and maintenance costs for all action alternatives are projected as a 20-year present worth with an inflation rate of 2.5% and an interest rate of 7.0%.

would constitute a major, adverse impact because Alternative 1 would not provide potable water that would meet federal and state drinking water standards with respect to concentrations of arsenic and fluoride, and potable water under this alternative would continue to be susceptible to fecal contamination.

The Furnace Creek area in Death Valley National Park is an area of abundant natural resources. Of particular concern are a minimum of eight endemic invertebrate special-status species that exist in the Texas-Travertine Springs complex. Alternative 3 would best fulfill the responsibilities of each generation as trustee of the environment by having a major, beneficial impact on this resource. Alternative 3 would discontinue water diversions from Travertine Springs Lines 2, 3, and 4 resulting in riparian releases to the aquatic environment below the collection galleries. Return of surface flows to the currently dry spring channels associated with Travertine Springs Lines 2, 3, and 4 would provide opportunities for the reintroduction of special-status species invertebrates into historic channels. Alternatives 2 and 4 would provide similar moderate, beneficial improvements to endemic invertebrate habitat; however, the habitat improvements under Alternatives 2 and 4 would not be at the same scale as under Alternative 3.

All alternatives would meet the legal water entitlements of local user groups, i.e., the National Park Service, Xanterra Parks and Resorts, and the Timbisha Shoshone Tribe.

- **NEPA Section 101 Requirement 2.** "Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings."

The action alternatives would similarly fulfill this goal; however, Alternative 1 would not. Under Alternative 1, potable water would continue to be provided that would not meet federal and state drinking water standards. As a result, Alternative 1 would not assure a safe, healthful environment in Furnace Creek. The action alternatives would provide potable water that would meet federal and state drinking water standards, as well as water quality recommendations by the California Department of Health Services with respect to boron concentrations.

All of the alternatives could result in minor to moderate, adverse impacts to archeological resources, historic structures, and cultural landscape resources. Under Alternative 1, the negligible to minor, adverse impacts to cultural resources would be due to potential degradation of archeological resources, historic structures, and cultural landscape resources associated with visitor use, routine maintenance and repairs, and natural processes. Such impacts could include removal of archeological materials, loss of information, changes in the setting of historic structures, and minor alterations of the cultural landscape. Under the action alternatives, the minor to moderate, adverse impacts to cultural resources would be due to potential disturbance of archeological resources, historic structures, ethnographic resources, and cultural landscape resources associated with ground-disturbing activities during construction, modifications to potentially historic structures, and ongoing maintenance of the water collection system.

With respect to scenic resources, the action alternatives would improve scenic resources in the Furnace Creek area due to proposed riparian restoration activities and the establishment of wetland and riparian areas. The beneficial effects to scenic resources associated with restoration improvements would offset adverse construction-related impacts and nominal increases in developed features associated with the action alternatives. Alternative 3 would result in the most new infrastructure and footprint impacts on previously undisturbed ground in the syncline because of the number of production wells and monitoring wells, and roads, utility corridors, and

pump houses associated with these wells. However, of the action alternatives, Alternative 3 would result in the most extensive restoration activities in the Texas-Travertine area because this alternative would release water from all four Travertine Springs and Texas Springs for riparian purposes. As a result, Alternative 3 would be environmentally preferable because it would best meet the goal of providing all Americans with aesthetically pleasing surroundings. Alternative 1 would not improve scenic resources in the Furnace Creek area.

- **NEPA Section 101 Requirement 3.** "Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences."

The action alternatives would fulfill goal 3 by providing a range of beneficial uses of the environment without degradation or risk of health or safety through the proposed improvements to the Furnace Creek water collection system. With respect to beneficial human use, each of the action alternatives would provide safe drinking water that would meet federal and state drinking water standards and would avoid adverse impacts to health and safety associated with providing unsafe potable water. Alternative 1 would not provide safe drinking water. Therefore, Alternative 1 would not fulfill this goal.

With respect to natural resource beneficial uses, Alternative 3 would result in the most new infrastructure and footprint impacts on previously undisturbed ground in the syncline because of the number of production wells and monitoring wells, and roads, utility corridors, and pump houses associated with these wells. However, Alternative 3 would be environmentally preferable due to proposed reestablishment of historic springs and wetlands in the Furnace Creek area. Alternative 3 would result in the most extensive riparian restoration effort at the Texas-Travertine Springs complex. Riparian areas are relatively rare in xeric environments, and are one of the rarest and most biologically diverse habitat types in the Mojave Desert. Alternative 3 would result in major, beneficial impacts to wetlands, vegetation, wildlife, and special-status species. Alternatives 2 and 4 would improve natural resources in the Furnace Creek area as well, but not to the same extent. Alternative 1 would not include riparian restoration efforts, and would not improve natural resource beneficial uses.

- **NEPA Section 101 Requirement 4.** "Preserve important historic, cultural, and natural aspects of our national heritage and maintaining, wherever possible, an environment that supports diversity and variety of individual choice."

As discussed under goal 3, above, Alternative 3 would be environmentally preferable due to proposed reestablishment of historic springs and wetlands in the Furnace Creek area. Alternative 3 would result in the most extensive riparian restoration effort at the Texas-Travertine Springs complex. Riparian areas are relatively rare in xeric environments, and are one of the rarest and most biologically diverse habitat types in the Mojave Desert. Alternative 3 would result in major, beneficial impacts to wetlands, vegetation, wildlife, and special-status species. Alternatives 2 and 4 would improve natural resources in the Furnace Creek area as well, but not to the same extent. Alternative 1 would not include riparian restoration efforts.

As discussed under goal 1, the Furnace Creek area in Death Valley National Park is an area of abundant natural resources. Of particular concern are a minimum of eight endemic invertebrate special-status species that exist in the Texas-Travertine Springs complex. Alternative 3 would best preserve important natural aspects of our national heritage by having a major, beneficial impact on this resource. Alternative 3 would discontinue water diversions from Travertine Springs

Lines 2, 3, and 4 resulting in riparian releases to the aquatic environment below the collection galleries. Return of surface flows to the currently dry spring channels associated with Travertine Springs Lines 2, 3, and 4 would provide opportunities for the reintroduction of special-status species invertebrates into historic channels. Alternatives 2 and 4 would provide similar moderate, beneficial improvements to endemic invertebrate habitat; however, the habitat improvements under Alternatives 2 and 4 would not be at the same scale as under Alternative 3.

As discussed under goal 2, above, all of the alternatives could result in minor to moderate adverse impacts to archeological resources, historic structures, ethnographic resources, and cultural landscape resources. Under Alternative 1, the negligible to minor, adverse impacts to cultural resources would be due to potential degradation of archeological resources, historic structures, and cultural landscape resources associated with visitor use, routine maintenance and repairs, and natural processes. Such impacts could include removal of archeological materials, loss of information, changes in the setting of historic sites, and minor alterations of the cultural landscape. Under the action alternatives, the minor to moderate, adverse impacts to cultural resources would be due to potential disturbance of archeological, historic, ethnographic, and cultural landscape resources associated with ground-disturbing activities during construction, modifications to potentially historic sites, and ongoing maintenance of the water collection system.

Modest improvements to the condition of the mesquite bosque under the action alternatives would assist in preserving important historic, cultural, and natural aspects of our national heritage. The action alternatives would have minor to moderate beneficial impacts on the mesquite bosque associated with the increased release of water for riparian restoration purposes, which through groundwater infiltration may increase the provision of water to this important ethnographic resource thereby restoring a portion of the water that historically went to the bosque and improving the condition of this resource. Among the action alternatives, Alternative 3 would return more riparian water to the environment than Alternative 2 or Alternative 4. Alternative 3 would therefore be slightly more environmentally preferable with respect to restoration of the mesquite bosque than Alternatives 2 and 4. Under Alternative 1, ongoing adverse effects to the mesquite bosque would continue to degrade the health and viability of the mesquite trees.

- **NEPA Section 101 Requirement 5.** "Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities."

Alternative 3 would best fulfill goal 5 by developing a water collection system in Furnace Creek that would provide safe potable water to area users in quantities that meet legal water entitlements, while also providing the most extensive reestablishment of the historic riparian environment compared to the other alternatives. Alternative 1 would not provide safe drinking water to area users, and would not restore historic riparian areas. Alternatives 2 and 4 would develop a water collection system that provides safe potable water to area users in quantities that meet legal water entitlements. The riparian restoration efforts under Alternatives 2 and 4, however, would not be as extensive as the proposed restoration effort under Alternative 3.

- **NEPA Section 101 Requirement 6.** "Enhance the quality of renewable resources and approaching the maximum attainable recycling of depletable resources."

Alternative 3 would best fulfill goal 6 by developing the most extensive array of alternative energy generation measures (e.g., solar and hydroelectric energy) in the Furnace Creek area compared to

the other alternatives. Alternative 3 would install a hydroelectric turbine downgradient from the proposed water treatment plant. This alternative would also install solar panels on the roofs of the proposed water treatment plant and two to three groundwater production well pump houses. Alternatives 2 and 4 would similarly develop alternative energy generation measures, but not to the same extent as Alternative 3. Alternatives 2 and 3 would both install a hydroelectric turbine downgradient from the proposed water treatment plant, and would install solar panels on the roof of the water treatment plant. Alternative 2 would have solar panels on the roofs of only two groundwater production well pump houses, and Alternative 4 (which does not include groundwater production wells) would have no additional solar panels. Alternative 1 would not develop alternative energy generation measures in the Furnace Creek area.

Environmentally Preferable Alternative Summary

The National Park Service determined that Alternative 3 (Preferred) as presented in this environmental impact statement would be environmentally preferable based on its furtherance of the Section 101 NEPA goals. Alternative 3 would best fulfill the responsibilities of each generation as trustee of the environment for succeeding generations by having a major, beneficial impact on endemic invertebrate special-status species that exist in the Texas-Travertine Springs complex. Alternative 3 would discontinue water diversions from Travertine Springs Lines 2, 3, and 4 resulting in riparian releases to the aquatic environment below the collection galleries. Alternatives 2 and 4 would provide similar moderate, beneficial improvements to endemic invertebrate habitat; however, the habitat improvements under Alternatives 2 and 4 would not be at the same scale as under Alternative 3.

Alternative 3 would best meet the goal of providing all Americans with safe, healthful, productive, and aesthetically and culturally pleasing surroundings. Of the action alternatives, Alternative 3 would result in the most extensive restoration activities in the Texas-Travertine area because this alternative would release water from all four Travertine Springs and Texas Springs for riparian purposes.

Alternative 3 would attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences. All of the action alternatives would fulfill goal 3 by providing safe drinking water that would meet federal and state drinking water standards; however, Alternative 3 would be environmentally preferable due to proposed reestablishment of historic springs and wetlands in the Furnace Creek area. Alternative 3 would result in the most extensive riparian restoration effort at the Texas-Travertine Springs complex, and would have major, beneficial impacts to wetlands, vegetation, wildlife, and special-status species. Alternatives 2 and 4 would improve natural resources in the Furnace Creek area as well, but not to the same extent.

With respect to preserving important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice, all of the action alternatives could result in minor to moderate adverse impacts to cultural resources. The adverse impacts to cultural resources would be due to potential disturbance of such resources associated with ground-disturbing activities during construction, modifications to potentially historic sites, and ongoing maintenance of the water collection system. Alternative 1 would have negligible to minor, adverse impacts to cultural resources due to potential degradation of archeological resources, historic structures, and cultural landscape resources associated with visitor use, routine maintenance and repairs, and natural processes.

Alternative 3 would be environmentally preferable, however, due to proposed reestablishment of historic springs and wetlands in the Furnace Creek area. Alternative 3 would result in the most extensive riparian restoration effort at the Texas-Travertine Springs complex. Alternatives 2 and 4 would improve natural resources in the Furnace Creek area as well, but not to the same extent. Alternative 1 would not include riparian restoration efforts.

Alternative 3 would achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities by developing a water collection system in Furnace Creek that would provide safe potable water to area users in quantities that meet legal water entitlements, while also providing the most extensive reestablishment of the historic riparian environment compared to the other alternatives.

Alternative 3 would enhance the quality of renewable resources by developing the most extensive array of alternative energy generation measures (e.g., solar and hydroelectric energy) in the Furnace Creek area compared to the other alternatives.

Alternatives Eliminated from Further Study

During the planning process, alternative actions were eliminated from detailed study for any one or a combination of the following reasons:

- Technical or economic infeasibility
- Inability to meet project objectives or resolve need
- Duplication with other, less environmentally damaging or less expensive alternatives
- Conflict with an up-to-date and valid park plan, statement of purpose and significance, or other policy such that a major change in the plan or policy would be needed to implement it
- Too great an environmental impact

Those alternative actions considered but eliminated from detailed study are described below.

Recycle Wastewater to Meet Nonpotable Water Needs

The National Park Service considered recycling wastewater to meet the users' nonpotable water needs. This action was assessed as technically feasible; however, the National Park Service has a limited quantity of wastewater available. Approximately 1.2 million gallons of wastewater is generated per month, which equates to approximately 23 gallons per minute (NPS 2004i). This volume of water would not sufficiently fulfill the project's need for nonpotable water, and may be economically infeasible due to the low available volume. This alternative was dismissed based upon economic infeasibility and inability to meet project objectives or resolve need.

Develop Point-source Water Treatment at All Facilities

The National Park Service considered developing point-source water treatment at all spring outlets planned for potable water supply. Although this alternative would be technically feasible, this dispersed method of water treatment would substantially increase the number of facilities required as well as energy and maintenance costs. The National Park Service determined that this alternative would be duplicative in function with other less environmentally damaging or less expensive alternatives (i.e., centralized water treatment). Water treatment facilities generate reject

water as part of the water treatment process. The amount of reject water generated at one large facility would be less than the amount of reject water generated at several small facilities due to economies of scale in water treatment technology. This alternative would result in too great an environmental impact due to the footprint impacts of individual water treatment facilities at each of the potable water sources, as well as increased reject water associated with the dispersed treatment system. This alternative was dismissed due to economic infeasibility, duplication with other less environmentally damaging or less expensive alternatives, and too great an environmental impact.

Arsenic and Fluoride Water Treatment

The National Park Service considered using anion exchange water treatment to treat potable water for arsenic and fluoride only. This alternative would meet some, but not all federal and state water quality standards. The National Park Service decided that the project purpose of providing a reliable quality of water and project goals associated with providing potable water that meets all federal and state water quality standards ought to include treatment of water to address total dissolved solids and boron. The National Park Service decided to dismiss this alternative in favor of providing reverse osmosis water treatment. This alternative was dismissed due to inability to meet project objectives or resolve need.

Combine Water Treatment to Single Location

The National Park Service considered consolidating water treatment for the Cow Creek and Furnace Creek areas at the existing water treatment facility at Cow Creek. The National Park Service indicated that this would require building a three-mile pipeline between Furnace Creek and Cow Creek, and would require pumping water uphill to Cow Creek. The National Park Service considered this alternative to be unsustainable, and noted that it would require development on previously undisturbed ground. This alternative was dismissed based upon technical and economic infeasibility.

Discharge of Concentrate Water and Sewage to Sewer System

The National Park Service considered conveying concentrate water and sewage generated from bathroom facilities in the proposed reverse osmosis water treatment plant to the sewer system as a disposal option. Infrastructure associated with this alternative would require installation of 6,400-linear feet of pipeline between the treatment plant and an existing sewer line near Sunset Campground. This alternative was dismissed because of the construction impacts associated with installing 6,400 linear feet of pipeline.

Concentrate Water Leach Field

The National Park Service considered disposal of concentrate water into a leach field southeast of the proposed reverse osmosis water treatment plant. This alternative was considered technically infeasible because subsurface sediments in this location have limited percolation potential, and there would be uncertainties with respect to whether it would be feasible to effectively dispose of concentrate water via a leach field. This alternative was therefore dismissed due to technical infeasibility.

Rebuild Travertine Springs Line 1, Travertine Springs Line 2, and Texas Springs

The National Park Service considered rebuilding Travertine Springs Line 1, Travertine Springs Line 2, and Texas Springs to provide potable water for Furnace Creek water users. Due to the presence of endemic invertebrates in these springs, the National Park Service determined that rebuilding Travertine Springs Line 1, Travertine Springs Line 2, and Texas Springs could have too great of an environmental impact on the survival of the species due to potential elimination of species habitat. This alternative was dismissed due to too great an environmental impact.

Collect Existing Untapped Seeps and Springs

The National Park Service considered collecting water in the Furnace Creek area from existing untapped seeps and springs. The National Park Service was concerned about this dispersed method of water collection, the requirement for an extensive piping system, and the need to pump water uphill to the 2-million gallon tank. Park staff was uncertain how many new spring and seep areas would need to be disturbed to collect sufficient water for user needs. This alternative would conflict with *General Management Plan* management objectives to protect natural and cultural resources and manage the maintenance program in a cost effective manner. The National Park Service noted that this alternative would not meet the park's objective to restore riparian areas, and would require disturbance in previously undisturbed areas. This alternative was dismissed due to an inability to meet project objectives, duplication with other less environmentally damaging or less expensive alternatives, conflict with a valid park plan, and would result in too great of an environmental impact.

Collect Nonpotable Water from Texas Springs

The National Park Service considered collecting nonpotable water from Texas Springs as an alternative component. The National Park Service analyzed the infrastructure of the existing water collection system and the topography of the project area, and determined that the most economically efficient source of nonpotable water would be Furnace Creek Wash and the Inn Tunnel. This alternative was dismissed based upon duplication with other less environmentally damaging or less expensive alternatives.

Drill Wells in the Furnace Creek Wash or Fan

The National Park Service considered drilling wells in the Furnace Creek Wash or Furnace Creek Fan. Upon consultation with the U.S. Geological Survey, it was determined that this alternative may not provide the desired water quantity, and water quality would be questionable. Furnace Creek Wash and Fan have a thinner water bearing strata; the potential quantity of water they can produce is less than could be pumped from the Texas Springs syncline. The National Park Service estimated that if four to six wells would be needed in the syncline, approximately 10 to 12 wells may be needed to supply an adequate water supply from Furnace Creek Wash or Fan. Water from Furnace Creek Wash also has a risk of contamination associated with runoff from or accidents along Highway 190 and as well as its location in relation to the existing sewer system. The National Park Service also was concerned about the sustainability of pumping water uphill to the 2-million gallon storage tank. In addition, the National Park Service was concerned about the impacts of this alternative on water supplied to the mesquite bosque. This alternative was dismissed due to technical infeasibility and due to too great an environmental impact.

Wells in the Salt Playa

The National Park Service considered an alternative that would involve drilling groundwater production wells in the salt playa. This alternative was considered technically infeasible because the geology in the salt playa would be unsuitable for groundwater production, and there would be uncertainties with respect to whether it would be feasible to construct, access, or maintain groundwater wells in the salt playa. In addition, wells in the salt playa would provide a questionable quantity and quality of water, which would not meet the project purpose. New development in the salt playa would not be consistent with the park's *General Management Plan*. Groundwater pumping and ground disturbance in the existing undisturbed salt playa would have too great an environmental impact due to the importance of this natural resource in the park. This alternative was dismissed due to technical infeasibility, inability to meet the project purpose, conflict with a valid park plan, and too great an environmental impact.

Capture Rainfall

The National Park Service considered capturing rainfall as an alternative for Furnace Creek water supply. Historically, the National Park Service has used a rainwater catchment system at Stovepipe Wells to provide water for park use. Park staff considered this alternative to be technically feasible, but unreliable to generate the volumes of water required to meet Furnace Creek water needs. The alternative would require building an extremely large rainwater catchment system, storage area, and pumping system. Development of a large-scale catchment system would not be consistent with the management actions identified in the park's *General Management Plan*. This alternative was dismissed due to its unreliability and inability to meet project objectives or resolve need, and conflict with a valid park plan.

Incorporate Rain-making Technologies

The National Park Service considered an alternative that would supply water to the Furnace Creek area through rain-making technologies, such as rain seeding. The National Park Service considered this alternative to be questionable from a technical perspective with respect to the reliability of rain seeding. Similar to the alternative that proposed capturing rainfall, this alternative would require large rainwater catchment basins. This alternative would not meet the project purpose of providing a reliable quality and quantity of water. In addition, this alternative would result in climate changes to Death Valley National Park, which would be in conflict with the 1916 Organic Act and the park's *General Management Plan*. This alternative was dismissed due to technical infeasibility, inability to meet the project purpose, and conflict with a valid park policy and plan.

Collect and Treat Water from Cow Creek for Furnace Creek Area User Needs

The National Park Service considered collecting and treating water from Cow Creek to supply user needs at Furnace Creek. Cow Creek is approximately three miles north of Furnace Creek and includes National Park Service maintenance, resources management, and employee housing facilities. The National Park Service noted that only 162 gpm of water is generated at Cow Creek. This water is being fully utilized in the Cow Creek area, and is not available for water uses at Furnace Creek. This alternative was dismissed based upon technical infeasibility and inability to meet project objectives or resolve need.

Import Water from Amargosa

The National Park Service considered importing water from Amargosa. The National Park Service does not have established water entitlements in this region, and noted that the alternative would require approximately 30 miles of pipeline, resulting in excessive ground disturbance impacts. This alternative would require pumping water uphill over approximately 1,500 feet of elevation for a 5-mile linear distance. In addition, the National Park Service would not support an action that may result in environmentally adverse impacts on Devils Hole pupfish. This alternative was dismissed based upon technical and economic infeasibility and due to too great an environmental impact.

Import Water from the Panamint Area

The National Park Service considered importing water from the Panamint Mountains area. The National Park Service noted that the alternative would require approximately 30 miles of pipeline across the salt playa, resulting in excessive ground disturbance impacts. Further, the National Park Service was not certain that the fragile playa would be able to physically support a water pipeline. The National Park Service noted that adverse effects to the salt playa would be in conflict with the park's *General Management Plan*. This alternative was dismissed based upon conflict with a park plan and due to too great an environmental impact.

Import Water from Northern Death Valley National Park Districts

The National Park Service considered importing water to the Furnace Creek area from springs such as Grapevine, Stainginger, Mesquite and others in the Scotty's Castle area (northern district) of the Death Valley National Park. The National Park Service considered this alternative to be technically infeasible with respect to whether there is sufficient water in these areas to provide a reliable water supply to Furnace Creek, as well as economically infeasible since the alternative would require piping water approximately 50 miles to the project area. This alternative could have too great an environmental impact associated with a new 50 mile pipeline in the park, as well as the uncertain environmental impacts on the riparian environments in the northern park districts associated with removing large volumes of water from their spring system for use in Furnace Creek. This alternative was dismissed due to technical and economic infeasibility, inability to meet project purpose, and too great an environmental impact.

Pipeline to Lake Mead or Las Vegas

The National Park Service considered developing a water supply pipeline to access water supplies at Lake Mead or Las Vegas. The National Park Service considered this alternative to be technically infeasible, since it would require constructing a pipeline approximately 150-miles in length over large elevation changes, and requiring more than 50 easements and rights-of-way to be obtained. In addition, this alternative may be economically infeasible with respect to whether there would be water rights available for purchase. This alternative would require ground-disturbance along a 150-mile corridor, which would have substantial environmental impacts. This alternative was dismissed due to technical and economic infeasibility and too great an environmental impact.

Evaluate Carrying Capacity and Reduce Use

The National Park Service considered evaluating the park's carrying capacity and reducing visitor use (such as the number of lodging units in Furnace Creek) as an alternative. The National Park Service noted that the water supplied in Furnace Creek is tied to legal water entitlements, and reductions in visitor numbers would not change the park's water delivery obligations associated with the legal water entitlements. In addition, substantial reductions in visitor numbers would require a major change in park policy, and would not be consistent with plan actions identified in the park's *General Management Plan*. This alternative was dismissed due to technical infeasibility (as a result of existing legal water entitlements) and conflict with a valid park plan.

Require Visitors and Employees to Bring Their Own Water

The National Park Service considered an alternative that would require park visitors and employees to bring their own water to the Furnace Creek area. The National Park Service considered this alternative to be technically infeasible due to concerns as to where large volumes of park visitors would purchase their drinking water. This alternative would not meet a project objective of providing safe drinking water. The National Park Service identified that this alternative would conflict with the 1916 Organic Act, and could create substantial water bottle recycling and sanitation issues. This alternative was dismissed due to technical infeasibility, inability to meet a project objective, and conflict with valid park policy.

Purchase In-holding and Entitlement to Manage the Area Consistent with the Organic Act

The National Park Service considered purchasing Xanterra's inholdings and water entitlement so that the area could be managed consistent with the 1916 Organic Act. The National Park Service determined that this alternative would be technically feasible since the agency has a history of purchasing inholdings; however, the alternative may not be economically feasible in the current fiscal climate due to the expected high valuation of Xanterra's private holdings in Furnace Creek. The National Park Service identified that this alternative would be outside the scope of the proposed action, because it would not fulfill the project purpose, need, and management goals, particularly with respect to providing a reliable quality and quantity of water that meets federal and state drinking water standards. This alternative was dismissed due to economic infeasibility and inability to meet project purpose, need, and management goals.

Mitigation Measures Common to All Action Alternatives

The National Park Service places a strong emphasis on avoidance, minimization, and mitigation of potential impacts. To help ensure that construction and/or operation of the action alternatives would be carried out in a manner that protects natural and cultural resources and the quality of the visitor experience, protective measures would be developed and implemented consistent with the guiding principles and commitments outlined in the park's *General Management Plan*. The mitigation measures common to the action alternatives are included in Appendix D, Mitigation Measures Common to All Action Alternatives.

Comparison of Alternatives

This section compares the key features of the alternatives and summarizes the potential environmental consequences. Table II-1 shows the maximum daily flow requirements of the alternatives and identifies the key components of the alternatives proposed for the Reconstruction of the Furnace Creek Water Collection System. Maximum daily flow requirements are the volume of water needed when (1) Furnace Creek facilities are at full occupancy and require their maximum daily flows of potable water, and (2) during the peak irrigation season when the Furnace Creek Inn and Ranch grounds and golf course require maximum daily flows of irrigation water. The maximum daily flow requirements would need to be met approximately 10% of the calendar year.

Table II-2 identifies the average daily flow requirements of the alternatives. The average daily flow requirements are the volume of water needed to meet average potable and nonpotable water demand. The average daily flow requirements would need to be met 100% of the calendar year, and would constitute the water withdrawals from the Furnace Creek system approximately 90% of the year.

Table II-3 summarizes and compares the potential environmental consequences associated with each alternative. Potential environmental consequences are analyzed in more detail in Chapter IV, Environmental Consequences.

Table II-1
Maximum Daily Flow Requirements and Key Components of the Alternatives [1]

Alternative Component	Alternative 1: No Action	Alternative 2	Alternative 3 (Preferred)	Alternative 4
Maximum Daily Flow Requirements	■ 600 gpm potable ■ 900 gpm nonpotable	■ Same as Alternative 1	■ Same as Alternative 1	■ Same as Alternative 1
Groundwater Production Wells	■ Not applicable	■ 2 Texas Springs Syncline Wells ■ 300 gpm potable	■ 2 to 3 Texas Springs Syncline Wells ■ 600 gpm potable	■ Not applicable
Anticipated Reduction in Flow from Travertine and Texas Springs due to Groundwater Pumping	■ Not applicable	■ 7 percent reduction in flow[2]	■ 24 percent reduction in flow[2]	■ Not applicable
Travertine Springs				
Line 1	■ 135 gpm riparian	■ 126 gpm riparian	■ 103 gpm riparian	■ 135 gpm riparian
Line 2	■ 377 gpm potable	■ 351 gpm riparian	■ 287 gpm riparian	■ 188 gpm potable ■ 189 gpm riparian
Line 3	■ 49 gpm potable	■ 49 gpm potable[3]	■ 37 gpm riparian	■ 49 gpm potable
Line 4	■ 251 gpm potable	■ 251 gpm potable[3]	■ 191 gpm riparian	■ 251 gpm potable
Texas Springs	■ 200 gpm riparian	■ 186 gpm riparian	■ 152 gpm riparian	■ 112 gpm potable ■ 88 gpm riparian
Furnace Creek Wash	■ 500 gpm potable	■ 600 gpm nonpotable[4]	■ 600 gpm nonpotable[4]	■ 600 gpm nonpotable[4]
Inn Tunnel	■ 145 gpm nonpotable ■ 155 gpm groundwater recharge	■ 300 gpm nonpotable[4]	■ 300 gpm nonpotable[4]	■ 300 gpm nonpotable[4]
Groundwater Monitoring Wells	■ 10 existing monitoring wells	■ 10 existing and 6 new monitoring wells	■ 10 existing and 7 new monitoring wells	■ 10 existing and 4 new monitoring wells
Concentrate Water	■ Not applicable	■ 120 gpm groundwater recharge	■ 120 gpm groundwater recharge	■ 120 gpm surface water release
Water Production Summary[5]	■ 1,177 gpm potable ■ 145 gpm nonpotable ■ 335 gpm riparian ■ 155 gpm groundwater recharge	■ 600 gpm potable[6] ■ 900 gpm nonpotable ■ 663 gpm riparian ■ 120 gpm groundwater recharge	■ 600 gpm potable[6] ■ 900 gpm nonpotable ■ 770 gpm riparian ■ 120 gpm groundwater recharge	■ 600 gpm potable[6] ■ 900 gpm nonpotable ■ 412 gpm riparian ■ 120 gpm surface water release

Table II-1 (Continued)
Maximum Daily Flow Requirements and Key Components of the Alternatives

Alternative Component	Alternative 1: No Action	Alternative 2	Alternative 3 (Preferred)	Alternative 4
Potable Water Treatment	▪ Chlorine treatment at 2-million gallon tank	▪ Treated for arsenic, boron, fluoride, and total dissolved solids removal with a reverse osmosis treatment plant ▪ Bypass water untreated	▪ Same as Alternative 2	▪ Same as Alternative 2 ▪ Bypass water treated
Culverts	▪ One 24-inch culvert crossing Highway 190 near Travertine Springs	▪ Two 36-inch culverts crossing Highway 190 near Travertine Springs, and one 36-inch culvert crossing Badwater Road	▪ Three 36-inch culverts crossing Highway 190 near Travertine Springs, and one 36-inch culvert crossing Badwater Road	▪ Same as Alternative 2
New Linear Feet of Pipeline	▪ Not applicable	▪ 17,200 linear feet	▪ 13,600 linear feet	▪ 5,450 linear feet
New or Improved Linear Feet of Roadway	▪ Not applicable	▪ 10,700 linear feet	▪ 15,200 linear feet	▪ 5,000 linear feet
Construction	▪ Not applicable	▪ 12-month construction period ▪ Spring 2007 through spring 2008 ▪ 6,000 truck trips ▪ 10 full-time equivalent workers	▪ Same as Alternative 2	▪ 9-month construction period ▪ Spring 2007 through winter 2008 ▪ 4,500 truck trips ▪ 10 full-time equivalent workers

[1] Flow rates and water usage identified under each alternative associated with water draws from Travertine and Texas Springs, Furnace Creek Wash, the Inn Tunnel, and the proposed groundwater production wells (under Alternatives 2 and 3) would be approximate. These flow rates would be used for water collection system design purposes, and actual flows may vary slightly.

[2] Spring discharges shown are reduced in comparison to the No Action Alternative to account for the effects of groundwater withdrawal from production wells under Alternatives 2 and 3 due to average daily flow requirements. It is estimated that an average of 129 gpm and 429 gpm would be pumped from the proposed groundwater production wells under Alternatives 2 and 3 to meet these requirements, as noted on Table II-2. The amount of 129 gpm is 7% of the 1,812 gpm that would be collected or discharged from the Furnace Creek system under the No Action Alternative, while 429 gpm is 24% of the 1,812 gpm that would be collected or discharged from the Furnace Creek system under the No Action Alternative. Due to the short-term and episodic nature of the maximum daily demand pumping requirements, groundwater pumping rates of 300-600 gpm would not be expected to substantially affect discharge from the spring outlets.

[3] Decreases in spring discharge associated with groundwater pumping would be offset in springs used for potable water supply by the reconstruction of spring collection boxes.

[4] Groundwater pumping from production wells in the Texas Springs Syncline would not be anticipated to reduce flows from the Inn Tunnel or Furnace Creek Wash collection systems under Alternatives 2 and 3 as these systems draw upon groundwater flowing in the alluvium of Furnace Creek Wash. Groundwater availability in Furnace Creek Wash would be affected by a decrease in flow from Travertine Springs due to groundwater pumping from the syncline; however, net groundwater flows in Furnace Creek Wash would be enhanced by increased riparian releases from Travertine Springs. In addition, reconstruction of the Furnace Creek Wash Collection Gallery under Alternatives 2, 3, and 4 would improve collection capabilities.

[5] The Water Production Summary for Alternative 1 represents average daily flow demands. In order to meet maximum daily flow demands, groundwater recharge releases from Inn Tunnel are reduced. On average, the Tribe's water use has historically not required full utilization of their 57 gpm water entitlement, lowering daily flow demands for the Furnace Creek water collection system. Water production capabilities under Alternative 1 would be unable to meet maximum daily flow demands should the Tribe fully utilize their water entitlement and peak potable and nonpotable demand occurs simultaneously.

[6] During the short-term and episodic periods under which maximum daily flow requirements exist (i.e., 600 gpm of potable water), raw water flows of 600 gpm would be supplemented with 120 gpm of treated water to be supplied from water storage.

Table II-2
Average Daily Flow Requirements[1]

Alternative Component	Alternative 1: No Action	Alternative 2	Alternative 3 (Preferred)	Alternative 4
Average Water Use	■ NPS: 63 gpm potable ■ Tribe: 57 gpm potable ■ Xanterra: 223 gpm potable and 780 gpm nonpotable ■ Total: 343 gpm potable and 780 nonpotable	■ Same as Alternative 1 ■ Raw water demands for treatment plant: 429 gpm potable[2]	■ Same as Alternative 2	■ Same as Alternative 2
Groundwater Production Wells	■ Not applicable	■ 129 gpm potable	■ 429 gpm potable	■ Not applicable
Anticipated Reduction in Flow from Travertine and Texas Springs due to Groundwater Pumping	■ Not applicable	■ 7 percent reduction in flow[3]	■ 24 percent reduction in flow[3]	■ Not applicable
Travertine Springs				
Line 1	■ 135 gpm riparian	■ 126 gpm riparian	■ 103 gpm riparian	■ 135 gpm riparian
Line 2	■ 377 gpm potable	■ 351 gpm riparian	■ 287 gpm riparian	■ 377 gpm riparian
Line 3	■ 49 gpm potable	■ 49 gpm potable[4]	■ 37 gpm riparian	■ 49 gpm potable
Line 4	■ 251 gpm potable	■ 251 gpm potable[4]	■ 191 gpm riparian	■ 251 gpm potable
Texas Springs	■ 200 gpm riparian	■ 186 gpm riparian	■ 152 gpm riparian	■ 129 gpm potable ■ 71 gpm riparian
Furnace Creek Wash	■ 500 gpm potable	■ 480 gpm nonpotable[5]	■ 480 gpm nonpotable[5]	■ 480 gpm nonpotable
Inn Tunnel	■ 145 gpm nonpotable ■ 155 gpm groundwater recharge	■ 300 gpm nonpotable[5]	■ 300 gpm nonpotable[5]	■ 300 gpm nonpotable
Concentrate Water	■ Not applicable	■ 86 gpm groundwater recharge	■ 86 gpm groundwater recharge	■ 86 gpm surface water release

Table II-2 (Continued)
Average Daily Flow Requirements[1]

Alternative Component	Alternative 1: No Action	Alternative 2	Alternative 3 (Preferred)	Alternative 4
Water Production Summary	■ 1,177 gpm potable ■ 145 gpm nonpotable ■ 335 gpm riparian ■ 155 gpm groundwater recharge	■ 429 gpm potable ■ 780 gpm nonpotable ■ 663 gpm riparian ■ 86 gpm groundwater recharge	■ 429 gpm potable ■ 780 gpm nonpotable ■ 770 gpm riparian ■ 86 gpm groundwater recharge	■ 429 gpm potable ■ 780 gpm nonpotable ■ 583 gpm riparian ■ 86 gpm surface water release

1 Flow rates and water usage identified under each alternative associated with water draws from Travertine and Texas Springs, Furnace Creek Wash, the Inn Tunnel, and the proposed groundwater production wells (under Alternatives 2 and 3) would be approximate. These flow rates would be used for water collection system design purposes, and actual flows may vary slightly.

2 The reverse osmosis water treatment plants would produce a concentrate water output flow of approximately 20% of raw water input, thereby requiring raw water inflow volumes of 120% of desired treated water output volumes. To meet the average daily flow requirements of 343 gpm of potable water, 429 gpm of untreated raw water would be needed.

3 Spring discharges shown are reduced in comparison to the No Action Alternative to account for the effects of groundwater withdrawal from production wells under Alternatives 2 and 3 due to average daily flow demand requirements. It is estimated that 129 gpm and 429 gpm would be pumped from the proposed groundwater production wells under Alternatives 2 and 3 to meet these requirements. The amount of 129 gpm is 7% of the 1,812 gpm that would be collected or discharged from the Furnace Creek system under the No Action Alternative, while 429 gpm is 24% of the 1,812 gpm that would be collected or discharged from the Furnace Creek system under the No Action Alternative. Due to the short-term and episodic nature of the maximum daily demand pumping requirements, groundwater pumping rates of 300-600 gpm would not be expected to substantially affect discharge from the spring outlets.

4 Decreases in spring discharge associated with groundwater pumping would be offset in springs used for potable water supply by the reconstruction of spring collection boxes.

5 Groundwater pumping from production wells in the Texas Springs Syncline would not be anticipated to reduce flows from the Inn Tunnel or Furnace Creek Wash collection systems under Alternatives 2 and 3 as these systems draw upon groundwater flowing in the alluvium of Furnace Creek Wash. Groundwater availability in Furnace Creek Wash would be affected by a decrease in flow from Travertine Springs due to groundwater pumping from the syncline; however, net groundwater flows in Furnace Creek Wash would be enhanced by increased riparian releases from Travertine Springs. In addition, reconstruction of the Furnace Creek Wash Collection Gallery under Alternatives 2, 3, and 4 would improve collection capabilities.

Table II-3
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
GEOLOGIC RESOURCES			
Under Alternative 1, discharge of excess water from the 2-million gallon tank would be expected to exacerbate erosion in the project area over time. Alternative 1 would result in a local, long-term, minor, adverse impact.	Construction activities under Alternative 2 may result in short-term, negligible, adverse impacts associated with erosion from construction-related grading and trenching activities such as development of roads to access proposed groundwater production and monitoring wells. These impacts would be minimized by implementation of erosion control mitigation measures and the general absence of substantial precipitation throughout the year. Erosion associated with the spring releases for riparian purposes would be minimized through implementation of water release control measures designed to reduce erosion, resulting in an overall local, long-term, minor, beneficial impact. Over time riparian vegetation at the springs would reduce erosion associated with upslope runoff.	Construction activities under Alternative 3 may result in short-term, negligible, adverse impacts associated with erosion from construction-related grading and trenching activities such as development of roads to access proposed groundwater production and monitoring wells. These impacts would be minimized by implementation of erosion control mitigation measures and the general absence of substantial precipitation throughout the year. Erosion associated with the spring releases for riparian purposes would be minimized through implementation of water release control measures designed to reduce erosion, resulting in an overall local, long-term, moderate, beneficial impact. Over time riparian vegetation at the springs would reduce erosion associated with upslope runoff.	Construction activities under Alternative 4 may result in short-term, negligible, adverse impacts associated with erosion, associated with construction grading and trenching activities. These impacts would be minimized by implementation of erosion control mitigation measures and the general absence of substantial precipitation throughout the year. Erosion associated with the spring releases from Travertine Springs Lines 1 and 2 and Texas Springs for riparian purposes and surface water release of concentrate water from the reverse osmosis water treatment plant would be minimized through implementation of water release control measures designed to reduce erosion, resulting in an overall local, long-term, minor, beneficial impact. Over time riparian vegetation at the springs would reduce erosion associated with upslope runoff.
GEOLOGIC HAZARDS			
Under Alternative 1, the Furnace Creek water collection system would continue to be subject to potential adverse impacts associated with damage from future seismic events. Risk of earthquake damage, however, would not be substantially greater than existing conditions. Therefore, Alternative 1 would have a local, long-term, minor, adverse impact.	Alternative 2 would have a local, long-term, minor, beneficial impact with respect to seismic hazards. Should seismic activity occur, the proposed groundwater production wells would be less susceptible to disruption of water service due to alterations of subsurface fractures and faults than the spring collection systems under Alternative 1. In addition, the proposed facilities would be constructed to meet current building code standards, and would be less susceptible to damage in the event of an earthquake. This beneficial impact would offset the adverse effect associated with expanding the water conveyance system and increasing the linear feet of pipeline susceptible to seismic damage.	Alternative 3 would have a local, long-term, minor, beneficial impact with respect to seismic hazards. Should seismic activity occur, the proposed groundwater production wells would be less susceptible to disruption of water service due to alterations of subsurface fractures and faults than the spring collection systems under Alternative 1. In addition, the proposed facilities would be constructed to meet current building code standards, and would be less susceptible to damage in the event of an earthquake. This beneficial impact would offset the adverse effect associated with expanding the water conveyance system and increasing the linear feet of pipeline susceptible to seismic damage.	Alternative 4 would have a local, long-term, minor, beneficial impact with respect to seismic hazards. The proposed reverse osmosis water treatment plant would be constructed to meet current building code standards, and would be less susceptible to damage in the event of an earthquake. This beneficial impact would offset the adverse effect associated with expanding the water conveyance system and increasing the linear feet of pipeline susceptible to seismic damage.

Table II-3 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
PALEONTOLOGICAL RESOURCES			
Alternative 1 would not alter the treatment of paleontological resources from their present condition. Degradation of paleontological resources such as fossils could occur due to visitor use, illicit collecting, routine maintenance and repairs, and natural processes. Local, long-term, minor, adverse impact under Alternative 1 would result from potential removal of fossils, damage to fossil beds, and loss of information.	Alternative 2 could result in local, long-term, moderate, adverse impacts to paleontological resources as a result of damage or destruction of fossils and fossil-bearing deposits during construction of pipelines, wells and associated roadways, and other construction-related activities. Degradation of paleontological resources also could occur due to ground-disturbing activities associated with ongoing maintenance and repair of the water system. Implementation of mitigation measures identified in Appendix D, Mitigation Measures Common to All Action Alternatives, including monitoring, identification, and development of appropriate treatment measures would result in a reduction of adverse impacts on paleontological resources from moderate to minor.	Alternative 3 could result in local, long-term, moderate, adverse impacts to paleontological resources as a result of damage or destruction of fossils and fossil-bearing deposits during construction of pipelines, wells and associated roadways, and other construction-related activities. Degradation of paleontological resources could occur due to ground-disturbing activities associated with ongoing maintenance and repair of the water system. Implementation of mitigation measures identified in Appendix D, Mitigation Measures Common to All Action Alternatives, including monitoring, identification, and development of appropriate treatment measures would result in a reduction of impacts to paleontological resources from moderate to minor.	Alternative 4 could result in local, long-term, moderate, adverse impacts to paleontological resources as a result of damage or destruction of fossils and fossil-bearing deposits during construction of pipelines, wells and associated roadways, the reverse osmosis water treatment plant, and other construction-related activities. Degradation of paleontological resources could occur due to ground-disturbing activities associated with ongoing maintenance and repair of the water system. Implementation of mitigation measures identified in Appendix D, Mitigation Measures Common to All Action Alternatives, including monitoring, identification, and development of appropriate treatment measures would result in a reduction of impacts to paleontological resources from moderate to minor.
HYDROLOGY			
Under Alternative 1, surface water resources in Furnace Creek would continue to be adversely affected by diversions associated with water collection activities, as all of Travertine Springs Lines 2, 3, and 4 would be used for water supply purposes. Existing water collection system components in Furnace Creek Wash also would continue to be subject to flooding, potentially necessitating repair by the National Park Service; however, these features would not affect flood flow dynamics. Groundwater would continue to be diverted from Furnace Creek Wash; however, the adverse effects to groundwater resource would be somewhat offset by the resource management and protection benefits	Under Alternative 2, groundwater pumping could result in a 7% decline of spring discharge rates in Texas Springs and Travertine Springs, and the springs complex between Travertine and Texas Springs due to the interconnected relation of surface water and groundwater at Furnace Creek. Although reduction of spring discharge rates would be an adverse impact, the restoration of spring discharge patterns at Travertine Springs Line 2 by releasing the entirety of spring flow for riparian purposes and initiation of concentrate water discharge from the reverse osmosis water treatment plant would result in a net, beneficial impact to surface water resources, as the net extent of stream channel lengths would increase. Groundwater pumping	Under Alternative 3, groundwater pumping would result in an approximate 24% decline of spring discharge rates in Texas Springs, Travertine Springs, and the springs between Travertine and Texas Springs due to the interconnected relation of surface water and groundwater at Furnace Creek. Although reduction of spring discharge rates would be an adverse impact, the restoration of spring discharge patterns at Travertine Springs Lines 2, 3, and 4 by releasing the entirety of spring flow for riparian purposes would result in a net, beneficial impact to surface water resources, as the net extent of stream channel lengths would increase. Groundwater pumping would adversely affect groundwater resources as groundwater levels in the	Under Alternative 4, surface water resources in Furnace Creek would continue to be adversely affected by diversions associated with water collection activities, as Travertine Springs Lines 3 and 4 would be used for water supply purposes. However, the ability of National Park Service to reduce diversions during non-peak demand periods would allow for nearly all of spring discharge at Travertine Springs Line 2 to be released for riparian purposes, thereby resulting in a net enhancement of stream channel length at Travertine Springs and in Furnace Creek Wash. Beneficial impacts associated with restoration of surface water flows and installation of four groundwater monitoring wells would outweigh adverse impacts on

Table II-3 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
HYDROLOGY (continued)			
provided by the existing network of groundwater monitoring wells. Overall, Alternative 1 would result in a local, long-term, minor, adverse impact.	would adversely affect groundwater resources by lowering groundwater levels in the Texas Springs Syncline and capturing water which would otherwise discharge from springs in the Furnace Creek area. However, the ability of the aquifer to recharge would not be affected and the groundwater system would re-equilibrate over time such that water level drawdown and spring discharge would stabilize. Water collection, discharge, and conveyance facilities in Furnace Creek Wash and Furnace Creek Fan would continue to be potentially damaged by flood flows, necessitating potential repair by the National Park Service; however, the proposed water conveyance line/collection gallery in the wash and percolation trench/concentrate water conveyance line in the fan would be subsurface features that would not be as affected by flood flows. Therefore, Alternative 2 would result in a local, long-term, moderate, beneficial impact.	Texas Springs Syncline would be lowered, and water that would otherwise discharge from springs in the Furnace Creek area would be captured; however, recharge to the aquifer would not be affected and the system would re-equilibrate over time such that groundwater levels and spring discharge would stabilize. Water collection and conveyance facilities in Furnace Creek Wash would continue to be potentially damaged by flood flows, necessitating potential repair by the National Park Service; however, the proposed water conveyance line, collection gallery in the wash, and concentrate water percolation trench would be subsurface features that would not be as affected by flood flows. Therefore, Alternative 3 would result in a local, long-term, minor, beneficial impact.	groundwater resources, particularly as replacement of the antiquated water collection infrastructure would result in an overall minor, beneficial impact associated with restoration of natural flow patterns and water resources in the Furnace Creek area. Water collection and conveyance facilities in Furnace Creek Wash would continue to be potentially damaged by flood flows, necessitating potential repair by the National Park Service; however, the proposed water conveyance line and collection gallery in the wash would include subsurface features that would not be as affected by flood flows. Overall, Alternative 4 would result in a local, long-term, minor beneficial impact.
WATER QUALITY			
Under Alternative 1, drinking water supplies at Furnace Creek would continue to exceed regulatory standards for arsenic and fluoride concentrations, and would continue to be susceptible to coliform bacteria contamination. The inability to meet drinking water standards under Alternative 1 would result in an overall local, long-term, major, adverse impact.	Alternative 2 would have a local, long-term, moderate, beneficial impact due to providing potable water in the Furnace Creek area that would meet federal and state drinking water quality standards and recommendations by the California Department of Health Services. Although construction- and operation-related activities under Alternative 2 would result in negligible and minor, adverse water quality impacts, respectively, the beneficial effects on water quality associated with meeting regulatory standards would offset these adverse impact on surface water and groundwater quality.	Alternative 3 would have a local, long-term, moderate, beneficial impact due to providing potable water in the Furnace Creek area that would meet federal and state drinking water quality standards and recommendations by the California Department of Health Services. Although construction- and operation-related activities under Alternative 3 would result in negligible and minor, adverse water quality impacts, respectively, the beneficial effects on water quality associated with meeting regulatory standards would offset these adverse impacts to surface water and groundwater quality.	Alternative 4 would have a local, long-term, moderate, beneficial impact due to providing potable water in the Furnace Creek area that would meet federal and state drinking water quality standards and recommendations by the California Department of Health Services. Although construction- and operation-related activities under Alternative 4 would result in negligible and minor, adverse water quality impacts, respectively, the beneficial effects on water quality associated with meeting regulatory standards would offset these adverse surface water quality impacts.

Table II-3 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
WETLANDS			
The Furnace Creek area contains a total of 12.243 acres of wetlands. Alternative 1 would continue to have a local, long-term, moderate, adverse effect on wetlands in the project area due to the limited size, quality, and connectivity of jurisdictional wetlands and Cowardin wetlands (palustrine forest, palustrine scrub-shrub, palustrine emergent, and riverine). Such effects would include compromised hydrologic connectivity, non-native species invasion, and reduced or lack of water.	Construction activities would affect a total of approximately 0.010 acres of wetlands, including palustrine emergent and riverine intermittent streambed due to installing culverts, a collection gallery, and nonpotable pipeline for connection at the Inn Tunnel. Alternative 2 would result in an approximately 98% increase in riparian water discharged from springs (under average and maximum daily flow requirements, incorporating potential reductions [7%] in spring flow from groundwater pumping) due to groundwater pumping in two groundwater wells and associated potable average water demands, primarily to wetlands at Travertine Springs Line 2. Groundwater pumping effects would reduce the extent of existing wetlands by approximately one acre; however, it is anticipated that approximately 38 acres of palustrine and riverine wetland habitat would be restored. Discharge of concentrate water would not result in effects to wetlands. With implementation of Best Management Practices and mitigation measures, the intensity of construction impacts to wetlands would be reduced to minor. Overall, Alternative 2 would have a local, long-term, moderate, beneficial impact on wetlands. The beneficial effects associated with allowing natural re-establishment of springs as a result of partial discontinuation of water diversion activities under this alternative and re-establishing riparian habitat in Furnace Creek Wash would outweigh the adverse construction-related impacts.	Construction activities would affect a cumulative total of approximately 0.013 acre of wetlands, including palustrine emergent and riverine intermittent streambed due to installing culverts and a Furnace Creek Wash collection gallery. Impacts may include erosion in streams, permanent disturbance to palustrine emergent wetlands, and temporary disturbance such as trampling to palustrine and riverine wetlands. Alternative 3 would result in an approximately 130% increase in riparian water discharged from the springs (under average and maximum daily flow requirements, incorporating potential reductions [24%] in spring flow from groundwater pumping). Groundwater pumping effects would potentially reduce the linear extent and size of wetlands by approximately 3 acres; however, it is anticipated that approximately 60 acres of palustrine and riverine wetland habitat would be restored. Discharge of concentrate water for groundwater recharge would not result in effects to wetlands. With implementation of Best Management Practices and mitigation measures (see Appendix D), the intensity of construction impacts to wetlands would be minor. Overall, Alternative 3 would have a local, long-term, major, beneficial impact on wetlands. The beneficial effects of discontinuing water diversions at Travertine Springs and Texas Springs under this alternative and re-establishing riparian habitat in Furnace Creek Wash would outweigh the adverse construction-related impacts.	Construction activities would affect a total of approximately 0.010 acres of wetlands, including palustrine emergent and riverine intermittent streambed due to installing culverts, a collection gallery, and a nonpotable pipeline. Alternative 4 would result in a 74% increase in riparian discharges from springs during average daily flow requirements, and would release slightly more water (412 gpm) for riparian use than Alternative 1 (335 gpm) during maximum daily flow requirements. It is anticipated that Alternative 4 would restore approximately 35 acres of palustrine and riverine wetlands in the Furnace Creek area. Discharge of concentrate water could slightly limit the extent and diversity of native wetland vegetation in the receiving water drainage. Implementation of Best Management Practices and mitigation measures, (including utilization of wetland protection and compensation measures), would reduce the intensity of construction impacts to wetlands to minor. Overall, Alternative 4 would have a local, long-term, moderate, beneficial impact on wetlands. The beneficial effects associated with shifting discharges from the disturbed wetland system at Texas Springs to Travertine Springs Line 2, where re-establishment of wetlands would increase the size of wetlands in the Travertine Springs system, and re-establishing riparian habitat in Furnace Creek Wash would outweigh the adverse construction-related impacts.

Table II-3 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
VEGETATION			
Alternative 1 would provide a limited comprehensive approach to improvements and management of natural plant communities. The size and continuity of riparian communities and the loss of natural drainage patterns would remain reduced because of water diversion activities. The size, continuity and quality of vegetation would continue to degrade due to the spread of non-native species. Effects on vegetation within the project area would result in a local, long-term, moderate, adverse impact.	Although the size of plant communities would be minimally reduced and vegetation trampling effects could occur during construction, discontinuation of water diversions at Travertine Springs Line 2 and implementation of the riparian water release standards would moderately improve vegetation in the long-term by increasing the size, quality, and continuity of wetland and upland vegetation, improving plant community dynamics, and enhancing species diversity within the project area. The effects of concentrate water discharge from the reverse osmosis water treatment plant for groundwater recharge and increased riparian releases from Travertine Springs Line 2 would result in a negligible, beneficial impact on vegetation due to augmentation of water supply to the mesquite bosque. Implementation of Best Management Practices and mitigation measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce construction-related effects to minor, and operation-related adverse effects (including encouraging the spread of invasive, non-native species in wetland areas) to minor. Overall, Alternative 2 would have a local, long-term, moderate, beneficial impact on vegetation. The beneficial effects associated with re-establishing historic springs and restoring wetland and upland vegetation in the Furnace Creek area would contribute appreciably and outweigh the adverse construction- and operation-related impacts.	The size of plant communities would be minimally reduced and vegetation trampling effects could occur during construction; however, increased flows from all lines of the Travertine Springs and Texas Springs systems for riparian allocation and implementation of the riparian release standards would improve vegetation in the long-term by greatly increasing the size, quality, and continuity of vegetation, improving plant community dynamics, and enhancing species diversity within the project area. The effects of concentrate water discharge from the reverse osmosis water treatment plant would result in a negligible, beneficial impact on vegetation due to augmentation of water supply to the mesquite bosque associated with concentrate water discharge and increased riparian releases from Travertine Springs. Implementation of best management practices and mitigation measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce construction-related effects to minor, and operation-related adverse effects (including encouraging the spread of invasive, non-native species) would be reduced to minor. Overall, Alternative 3 would have a local, long-term, major, beneficial impact on vegetation. The beneficial effects associated with re-establishing historic springs and wetland vegetation at Travertine Springs and Texas Springs systems would outweigh the adverse construction- and operation-related impacts.	The size of plant communities would be minimally reduced and vegetation trampling effects could occur during construction; however, discharges from springs under Alternative 4 and implementation of the riparian release standards would improve vegetation in the long-term by moderately increasing the size, quality and continuity of wetland vegetation, improving plant community dynamics and enhancing species diversity within the project area. Implementation of best management practices and mitigation measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce adverse construction-related effects to minor, and adverse operation-related effects (including encouraging the spread of invasive, nonnative species) to minor. Overall, Alternative 4 would have a local, long-term, moderate, beneficial impact on vegetation. The beneficial effects associated with re-establishing historic springs and wetland vegetation in Furnace Creek area would outweigh the adverse construction-related impacts.

Table II-3 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
WILDLIFE			
Under Alternative 1, the maintenance of the current levels and locations of surface water diversions would continue to adversely affect wildlife habitat in the Furnace Creek area. The already degraded conditions of aquatic and riparian wildlife resources within the project area would likely persist. Therefore, Alternative 1 would have local, long-term, moderate, adverse impacts on wildlife.	Construction-related activities would have a minor to moderate adverse effect on wildlife through habitat disturbance, noise, human presence, and operation of heavy equipment. Implementation of Best Management Practices and mitigation measures such as preconstruction wildlife surveys and erosion and sedimentation control measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce the magnitude of the adverse effects on wildlife to minor. Overall, Alternative 2 would have a local, long-term, moderate, beneficial effect on wildlife due to an increase in riparian discharges, and concomitant increases in aquatic and riparian habitat availability, in the Furnace Creek area. The beneficial effects associated with the reestablishment of wildlife habitat at Travertine Springs Line 2, and the extension of such habitat in the Furnace Creek Wash due to the relocation of the collection gallery, would outweigh the adverse construction-related and groundwater pumping-related impacts, as well as the impacts of eliminating groundwater recharge at the Inn Tunnel and slightly reducing discharges at the spring complex located between Travertine and Texas Springs. Alternative 2 would have local, long-term, moderate, beneficial impact on wildlife.	Construction-related activities would have a minor to moderate adverse effect on wildlife through habitat disturbance, noise, human presence, and operation of heavy equipment. Implementation of Best Management Practices and mitigation measures such as preconstruction wildlife surveys and erosion and sedimentation control measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce the magnitude of the adverse effects on wildlife to minor. Overall, Alternative 3 would have a local, long-term, major, beneficial effect on wildlife due to an overall increase in riparian discharges, and concomitant increases in aquatic and riparian habitat availability, in the Furnace Creek area. The beneficial effects associated with the reestablishment of wildlife habitat at Travertine Springs Lines 2, 3, and 4, and the extension of such habitat in the Furnace Creek Wash due to the relocation of the collection gallery, would outweigh the adverse construction-related effects, potential groundwater pumping-related and erosional impacts, and the effects of eliminating groundwater recharge at the Inn Tunnel associated with this alternative. Alternative 3 would have local, long-term, major, beneficial impact on wildlife.	Construction-related activities would have a minor to moderate adverse effect on wildlife through habitat disturbance, noise, human presence, and operation of heavy equipment. Implementation of Best Management Practices and mitigation measures such as preconstruction wildlife surveys and erosion and sedimentation control measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce the magnitude of the adverse effects on wildlife to minor. Overall, Alternative 4 would have a local, long-term, moderate, beneficial effect on wildlife due to the overall shift of riparian discharges from disturbed habitat at Texas Springs and the percolation trench at the Inn Tunnel to historic spring channels at Travertine Springs Line 2, where the potential for successful restoration of historic wildlife habitat appears to be high. Furthermore, the downstream relocation of the Furnace Creek Wash gallery would result in an increase in wildlife habitat at that location. The beneficial effects associated with the re-establishment of wildlife habitat at Travertine Springs Line 2 and the extension of such habitat in the Furnace Creek Wash would outweigh the adverse construction-related impacts and loss of groundwater recharge at the Inn Tunnel and riparian discharges at Texas Springs associated with this alternative. Alternative 4 would have local, long-term, moderate, beneficial impact on wildlife.

Table II-3 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
SPECIAL-STATUS SPECIES			
Under Alternative 1, the maintenance of the current levels and locations of surface water diversions would continue to adversely affect special-status species and their habitat in the Furnace Creek area. The already degraded conditions of aquatic and riparian habitats within the project area would likely persist. Alternative 1 would have local, long-term, moderate to major, adverse impacts on special-status species. The existing adverse impacts to special- status invertebrates would be expected to persist. The future extinction of one or more endemic invertebrate species would be a distinct possibility under Alternative 1.	Construction-related activities would have a minor to moderate adverse effect on special-status species through habitat disturbance (including trampling), noise, human presence, and operation of heavy equipment. Implementation of Best Management Practices and mitigation measures such as preconstruction surveys, maintenance of routes of escape from excavated pits and trenches for animals that might fall in, and avoidance of special-status plant species (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce the magnitude of the adverse effects on special-status species to minor. Overall, Alternative 2 would have a local, long-term, moderate, beneficial effect on special-status species due to an overall increase in riparian discharges, and concomitant increases in aquatic and riparian habitat availability, in the Furnace Creek area. The beneficial effects associated with the reestablishment of wetland and riparian habitat at Travertine Springs Line 2, and the extension of such habitat in the Furnace Creek Wash due to the relocation of the collection gallery, would outweigh the adverse construction-related and groundwater pumping-related impacts, the impacts of eliminating groundwater recharge from the Inn Tunnel, and the potential effects of erosion at riparian discharge locations. Alternative 2 would have local, long-term, moderate, beneficial impact on special-status species.	Construction-related activities would have a minor to moderate adverse effect on special-status species through habitat disturbance (including trampling), noise, human presence, and operation of heavy equipment. Implementation of Best Management Practices and mitigation measures such as preconstruction surveys, maintenance of routes of escape from excavated pits and trenches for animals that might fall in, and avoidance of special-status plant species (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce the magnitude of the adverse effects on special-status species to minor. Overall, Alternative 3 would have a local, long-term, major, beneficial effect on special-status species due to a substantial increase in riparian discharges, and concomitant increases in aquatic and riparian habitat availability, in the Furnace Creek area. The beneficial effects associated with the reestablishment of wetland and riparian habitat at Travertine Springs Lines 2, 3, and 4, and the extension of such habitat in the Furnace Creek Wash area due to the relocation of the collection gallery, would outweigh the adverse construction-related and groundwater pumping-related impacts, the effects of eliminating groundwater recharge at the Inn Tunnel and reducing discharges at the spring complex located between Travertine and Texas Springs, and the potential effects of erosion at the spring discharge locations. Alternative 3 would have local, long-term, major, beneficial impact on special-status species.	Construction-related activities would have a minor to moderate adverse effect on special-status species through habitat disturbance (including trampling), noise, human presence, and operation of heavy equipment. Implementation of Best Management Practices and mitigation measures such as preconstruction surveys, maintenance of routes of escape from excavated pits and trenches for animals that might fall in, and avoidance of special-status plant species (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce the magnitude of the adverse effects on special-status species to minor. Overall, Alternative 4 would have a local, long-term, moderate, beneficial effect on special-status species due to an overall increase in riparian discharges, and concomitant increases in aquatic and riparian habitat availability, in the Furnace Creek area. The beneficial effects associated with the reestablishment of wetland and riparian habitat at Travertine Springs Line 2 and the extension of such habitat in the Furnace Creek Wash due to the relocation of the collection gallery, would outweigh the adverse construction-related impacts, as well as the impacts of eliminating groundwater recharge at the Inn Tunnel, reducing riparian discharges at Texas Springs, and the potential effects of erosion at riparian discharge locations. Alternative 4 would have local, long-term, moderate, beneficial impact on special-status species.

Table II-3 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
AIR QUALITY			
Under Alternative 1, there would be no additional increase or decrease to air quality compared to current conditions, and no impact would occur.	Alternative 2 would have a local, long-term, negligible, adverse effect on air quality. With mitigation measures, the effect of air pollutant emissions associated with construction activities at the project site under Alternative 2 would be negligible due to the intensity of construction and the distance between the construction sites and sensitive receptors. Groundwater production wells and the reverse osmosis water treatment plant constructed under Alternative 2 would be electrically powered and minimal new traffic would be associated with ongoing operation of the proposed water system resulting in negligible, adverse effects to the air quality in the Furnace Creek area.	Alternative 3 would have a local, long-term, negligible, adverse effect on air quality. With mitigation measures, the effect of air pollutant emissions associated with construction activities at the project site under Alternative 3 would be negligible due to the intensity of construction and the distance between the construction sites and sensitive receptors. Groundwater production wells and the reverse osmosis water treatment plant constructed under Alternative 3 would be electrically powered and minimal new traffic would be associated with ongoing operation of the proposed water system resulting in negligible, adverse effects to the air quality in the Furnace Creek area.	Alternative 4 would have a local, long-term, negligible, adverse effect on air quality. With mitigation measures, the effect of air pollutant emissions associated with construction activities at the project site under Alternative 4 would be negligible due to the intensity of construction and the distance between the construction sites and sensitive receptors. The reverse osmosis water treatment plant constructed under Alternative 4 would be electrically powered and minimal new traffic would be associated with ongoing operation of the proposed water system resulting in negligible, adverse effects to the air quality in the Furnace Creek area.
SOUNDSCAPES			
Under Alternative 1, there would be no additional increase or decrease to noise levels compared to current conditions.	Alternative 2 would have a local, short-term, minor, adverse effect on the ambient soundscape environment associated with construction-related noise. Operation of the water collection system under Alternative 2 would result in a local, long-term, negligible, adverse impact. The two groundwater production wells, reverse osmosis water treatment plant, hydroelectric turbine, and minimal new traffic associated with ongoing operation of the proposed water system would result in negligible adverse effects to the ambient soundscape environment in the Furnace Creek area that would not be of any measurable or perceptible consequence to the visitor experience.	Alternative 3 would have a local, short-term, minor, adverse effect on the ambient soundscape environment associated with construction-related noise. Operation of the water system under Alternative 3 would result in a local, long-term, negligible, adverse impact. The two to three groundwater production wells, reverse osmosis water treatment plant, hydroelectric turbine, and minimal new traffic associated with ongoing operation of the proposed water system would result in negligible, adverse effects to the ambient soundscape environment in the Furnace Creek area that would not be of any measurable or perceptible consequence to the visitor experience.	Alternative 4 would have a local, short-term, minor, adverse effect on the ambient soundscape environment associated with construction-related noise. Operation of the water system under Alternative 4 would result in a local, long-term, negligible, adverse impact. The reverse osmosis water treatment plant, hydroelectric turbine, and minimal new traffic associated with ongoing operation of the proposed water system would result in negligible, adverse effects to the ambient soundscape environment in the Furnace Creek area that would not be of any measurable or perceptible consequence to the visitor experience.

Table II-3 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
CULTURAL RESOURCES *ARCHEOLOGICAL RESOURCES*			
Localized, negligible to minor impacts to archeological resources would continue due to visitor use, routine maintenance and repairs, and natural processes. Because there would be no new ground disturbance, impacts to archeological resources would be local, long-term, negligible to minor, and adverse.	Construction activities and long-term operational activities under the implementation of Alternative 2 could result in local, long-term, minor to moderate, adverse impacts to archeological resources. In the event adverse impacts to National Register eligible archeological resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Construction activities and long-term operational activities associated with the implementation of Alternative 3 could result in local, long-term, minor to moderate, adverse impacts to archeological resources. In the event adverse impacts to National Register eligible archeological resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Construction activities and long-term operational activities under the implementation of Alternative 4 could result in local, long-term, minor to moderate, adverse impacts to archeological resources. In the event adverse impacts to National Register eligible archeological resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.
HISTORIC STRUCTURES			
Visitor use, routine maintenance and repairs, and natural weathering processes would continue to have a local, negligible to minor impact on historic structures. Alternative 1 would have local, long-term, negligible to minor, adverse impacts to historic structures.	Construction activities and long-term operational activities under the implementation of Alternative 2 could result in local, long-term, minor to moderate, adverse impacts to historic structures. In the event adverse impacts to National Register eligible historic structures could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Construction activities and long-term operational activities associated with the implementation of Alternative 3 could result in local, long-term, minor to moderate, adverse impacts to historic structures. In the event adverse impacts to National Register eligible historic structures could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Construction activities and long-term operational activities associated with the implementation of Alternative 4 could result in local, long-term, minor to moderate, adverse impacts to historic structures. In the event adverse impacts to National Register eligible historic structures could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.
ETHNOGRAPHIC RESOURCES			
On-going impacts to the mesquite bosque would continue resulting in local, long-term, moderate, adverse impacts to ethnographic resources.	Alternative 2 could have a local, long-term, minor to moderate, adverse impact on ethnographic resources due to potential disturbance of such resources during construction-related activities, including changes in setting. The release of water for riparian restoration and concentrate water for groundwater recharge would beneficially affect the mesquite bosque. In the event adverse impacts to National Register eligible ethnographic resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Alternative 3 could have a local, long-term, minor to moderate, adverse impact on ethnographic resources due to potential disturbance of such resources during construction-related activities including changes in setting. The release of water for riparian restoration and concentrate water for groundwater recharge would beneficially effect the mesquite bosque. In the event adverse impacts to National Register eligible ethnographic resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Alternative 4 could have a local, long-term, minor to moderate, adverse impact on ethnographic resources due to potential disturbance of such resources during construction-related activities, including changes in setting. The release of water for riparian restoration and concentrate water for groundwater recharge would beneficially affect the mesquite bosque. In the event adverse impacts to National Register eligible ethnographic resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.

Table II-3 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
		CULTURAL LANDSCAPE RESOURCES	
Negligible to minor degradation due to visitor use, routine maintenance and repairs, and natural processes would continue. There would be no actions undertaken under Alternative 1 that would result in any new impacts to cultural landscapes, therefore implementation of Alternative 1 would result in continued local, long-term, negligible to minor, adverse impacts to cultural landscapes.	Construction activities and long-term operational activities associated with the implementation of Alternative 2 could result in local, long-term, minor to moderate, adverse impacts to cultural landscape resources. In the event adverse impacts to National Register eligible cultural landscape resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Construction activities and long-term operational activities associated with the implementation of Alternative 3 could result in local, long-term, minor to moderate, adverse impacts to cultural landscape resources. In the event adverse impacts to National Register eligible cultural landscape resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts.	Construction activities and long-term operational activities associated with the implementation of Alternative 4 could result in local, long-term, minor to moderate, adverse impacts to cultural landscape resources. In the event adverse impacts to National Register eligible cultural landscape resources could not be avoided, stipulations in the PA would be used to mitigate any adverse impacts identified in Appendix D, Mitigation Measures Common to All Action Alternatives, including implementation of the stipulations of the PA executed in compliance with Section 106 of the NHPA, would result in identification of cultural landscape resources and in mitigation of any adverse impacts to cultural landscape resources as a result of construction and operation-related activities, reducing impacts from major to moderate.
		VISITOR EXPERIENCE	
The continued unreliability of the Furnace Creek water system supply and quality and ongoing erosion at Texas Springs would detract from the use of recreational resources in the Furnace Creek area and would have a local, long-term, minor, adverse impact on recreation resources in the Furnace Creek area. Orientation and interpretation services and opportunities would continue to be available through the Furnace Creek Visitor Center and other park resources. Alternative 1 would have no impact on orientation and operation resources in the Furnace Creek area. The continued unreliability of the Furnace Creek water system supply and quality would detract from the use of visitor facilities in the Furnace Creek area and would have a local, long-term, minor, adverse impact on	Under Alternative 2, construction activities would disrupt use of and access to recreation opportunities in the project area and adjacent areas resulting in a local, short-term, minor, adverse impact in the project area compared to Alternative 1. Overall, Alternative 2 would result in a local, long-term, minor, beneficial impact compared to Alternative 1, due to improved water supply reliability and quality to recreation areas and improved sightseeing opportunities related to riparian and mesquite bosque restoration. Facility construction under Alternative 2 would disrupt orientation and interpretation opportunities in the project area resulting in a local, short-term, minor, adverse impact to orientation and interpretation compared to Alternative 1.	Under Alternative 3, construction activities would disrupt use of and access to recreation opportunities in the project area and adjacent areas resulting in a local, short-term, minor, adverse impact in the project area compared to Alternative 1. Overall, Alternative 3 would result in a local, long-term, minor, beneficial impact compared to Alternative 1, due to improved water supply reliability and quality to recreation areas and improved sightseeing opportunities related to riparian restoration. Facility construction under Alternative 3 would disrupt orientation and interpretation opportunities in the project area resulting in a local, short-term, minor, adverse impact to orientation and interpretation compared to Alternative 1. Orientation and interpretation services	Under Alternative 4, construction activities would disrupt use of and access to recreation opportunities in the project area and adjacent areas resulting in a local, short-term, minor, adverse impact in the project area compared to Alternative 1. Overall, Alternative 4 would result in a local, long-term, minor, beneficial impact compared to Alternative 1, due to improved water supply reliability and quality to recreation areas and improved sightseeing opportunities related to riparian restoration. Facility construction under Alternative 4 would disrupt orientation and interpretation opportunities in the project area resulting in a local, short-term, minor, adverse impact to orientation and interpretation compared to Alternative 1.

Table II-3 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
VISITOR EXPERIENCE (continued)			
visitor services in the Furnace Creek area. Under Alternative 1, existing facilities would not be readily apparent from Wilderness areas and visitors to those areas would continue to experience solitude, natural quiet, and backcountry scenery. Alternative 1 would have no impact on Wilderness experience in the Furnace Creek area and vicinity.	Orientation and interpretation services and opportunities would continue to be available through the Furnace Creek Visitor Center and other park resources. Alternative 2 would have no operation-related impacts on orientation and interpretation resources in the Furnace Creek area. Under Alternative 2, construction activities would disrupt use of existing visitor-service facilities resulting in a local, short-term, minor, adverse impact to visitor services compared to Alternative 1. Overall, operation of park visitor service facilities under Alternative 2 would include a reliable water supply that meets State water quality requirements and would result in an overall local, long-term, minor, beneficial impact compared to Alternative 1.Construction activities under Alternative 2 would include activities at the Texas Springs Syncline that are near Wilderness areas and could result in disruption to use and enjoyment of Wilderness areas by temporarily reducing the solitude, natural quiet, and backcountry scenery of Wilderness areas, resulting in a local, short-term, minor, adverse impact on the Wilderness experience in the Furnace Creek area compared to Alternative 1. Following the restoration of construction areas, most water supply facilities would be below ground or at-grade and would not be readily apparent from Wilderness areas. Therefore, operation under Alternative 2 would have a local, long-term, negligible, adverse impact on the Wilderness experience in the Furnace Creek area compared to Alternative 1.	and opportunities would continue to be available through the Furnace Creek Visitor Center and other park resources. Alternative 3 would have no operation-related impacts on orientation and interpretation resources in the Furnace Creek area. Under Alternative 3, construction activities would disrupt use of existing visitor-service facilities resulting in a local, short-term, minor, adverse impact to visitor services compared to Alternative 1. Operation of park visitor service facilities under Alternative 3 would include a reliable water supply that meets State water quality requirements and would result in an overall local, long-term, minor, beneficial impact compared to Alternative 1. Construction activities under Alternative 3 would include activities at the Texas Springs Syncline area that are near Wilderness areas and could result in disruption to use and enjoyment of Wilderness areas by temporarily reducing the solitude, natural quiet, and backcountry scenery of Wilderness areas, resulting in a local, short-term, minor, adverse impact on the Wilderness experience in the Furnace Creek area compared to Alternative 1. Following construction and restoration of construction areas, most water supply facilities would be below ground or at-grade and would not be readily apparent from Wilderness areas. Therefore, operation under Alternative 3 would have a local, long-term, negligible, adverse impact on the Wilderness experience in the Furnace Creek area compared to Alternative 1.	Orientation and interpretation services and opportunities would continue to be available through the Furnace Creek Visitor Center and other park resources. Alternative 4 would have no operation-related impacts on orientation and interpretation resources in the Furnace Creek area. Under Alternative 4, construction activities would disrupt use of existing visitor-service facilities resulting in a local, short-term, minor, adverse impact to visitor services compared to Alternative 1. Operation of park visitor service facilities under Alternative 4 would include a reliable water supply that meets State water quality requirements and would result in an overall local, long-term, minor, beneficial impact compared to Alternative 1.Construction activities under Alternative 4 would include activities located approximately one mile from Wilderness areas. These activities may be somewhat apparent from Wilderness areas, temporarily reducing the solitude, natural quiet, and backcountry scenery of Wilderness areas, resulting in a local, short-term, negligible to minor, adverse impact on the Wilderness experience in the Furnace Creek area compared to Alternative 1. Following restoration of construction areas, water supply facilities in this area would not be readily apparent from Wilderness areas. Therefore, operation under Alternative 4 would have a local, long-term, negligible, adverse impact on the Wilderness experience in the Furnace Creek area compared to Alternative 1.

Table II-3 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
TRANSPORTATION			
Continuation of the current management activities related to the water collection system would cause local, long-term, moderate, adverse impacts to traffic safety and roadway structural conditions.	Alternative 2 would have a local, long-term, moderate, beneficial impact on traffic safety and roadway structural conditions. Implementation of Best Management Practices and mitigation measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce construction-related effects to negligible. Overall, Alternative 2 would have a local, long-term, moderate, beneficial impact on traffic safety and roadway structural conditions.	Alternative 3 would have a local, long-term, moderate, beneficial impact on traffic safety and roadway structural conditions. Implementation of Best Management Practices and mitigation measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce construction-related effects to negligible. Overall, Alternative 3 would have a local, long-term, moderate, beneficial impact on traffic safety and roadway structural conditions.	Alternative 4 would have a local, long-term, moderate, beneficial impact on traffic safety and roadway structural conditions. Implementation of Best Management Practices and mitigation measures (see Appendix D, Mitigation Measures Common to All Action Alternatives) would reduce construction-related effects to negligible. Overall, Alternative 4 would have a local, long-term, moderate, beneficial impact on traffic safety and roadway structural conditions.
SCENIC RESOURCES			
The continued presence of built features in the natural environment at Furnace Creek and ongoing erosion at Texas Springs would detract from the visual character of the area and would have a local, long-term, minor, adverse impact on scenic resources in the Furnace Creek area.	The construction effort for Alternative 2 would have local, short-term, moderate, adverse impacts to scenic resources. Adverse construction-related impacts would be associated with clearly visible demolition and construction activities that would detract from the visual setting of the Furnace Creek area. Alternative 2 would have a local, long-term, minor, beneficial impact on scenic resources compared to Alternative 1. The beneficial effects associated with the proposed riparian restoration activities and the reestablishment of historic wetland and riparian areas at Travertine Springs Lines 1 and 2 and Texas Springs would offset the adverse effects to scenic resources associated with the increased developed features (such as the proposed reverse osmosis water treatment plant, two groundwater wells and associated pump houses, and monitoring wells) at the project site.	The construction effort for Alternative 3 would have local, short-term, moderate, adverse impacts to scenic resources. Adverse construction-related impacts would be associated with clearly visible demolition and construction activities that would detract from the visual setting of the Furnace Creek area. Alternative 3 would have a local, long-term, minor, beneficial impact on scenic resources compared to Alternative 1. The beneficial effects associated with the proposed riparian restoration activities and the reestablishment of historic wetland and riparian areas at all four Travertine Springs and Texas Springs would offset the adverse effects to scenic resources associated with the increased developed features (such as the proposed reverse osmosis water treatment plant, two to three groundwater wells and associated pump houses, and monitoring wells) at the project site.	The construction effort for Alternative 4 would have local, short-term, minor, adverse impacts to scenic resources. Adverse construction-related impacts would be associated with clearly visible demolition and construction activities that would detract from the visual setting of the Furnace Creek area. Alternative 4 would have a local, long-term, minor beneficial impact on scenic resources compared to Alternative 1. The beneficial effects associated with the proposed riparian restoration activities and the reestablishment of historic wetland and riparian areas at Travertine Springs Lines 1 and 2 and Texas Springs (based on partial and not total release of riparian water from Texas Springs and Travertine Springs Line 2) would offset the adverse effects to scenic resources associated with the increased developed features (such as the proposed reverse osmosis water treatment plant and monitoring wells) at the project site.

Table II-3 (Continued)
Summary of Environmental Consequences

Alternative 1 No Action	**Alternative 2**	**Alternative 3** Preferred	**Alternative 4**
SOCIOECONOMICS			
Alternative 1 would have a local, short-term, moderate, adverse operation-related impact on the local economy and community associated with potential water service failures or deficiencies. Similarly, Alternative 1 would have a regional, short-term, negligible to minor, adverse operation-related impact on the regional economy associated with potential water service failures or deficiencies. The impacts would be short-term due to the temporary nature of a potential water service failure or system deficiency.	Alternative 2 would have a local, long-term, minor, beneficial effect on the socioeconomic environment due to the beneficial effect of the improved water security system on the character of the social and economic environments. Proposed short-term construction and long-term operation and maintenance spending associated with Alternative 2 would total $2.5 million for construction and approximately $2.1 million for operation and maintenance of the proposed water system. Proposed construction and operation and maintenance spending would have a regional, long-term, negligible, beneficial impact on the regional economy. The magnitude of the proposed spending would not be expected to have a discernable effect on the regional economy.	Similar to Alternative 2, Alternative 3 would have a local, long-term, minor, beneficial effect on the socioeconomic environment due to the beneficial effect of the improved water security system on the character of the social and economic environments. Proposed short-term construction and long-term operation and maintenance spending associated with Alternative 3 would total $2.5 million for construction and approximately $2.2 million for operation and maintenance of the proposed water system. Proposed construction and operation and maintenance spending would have a regional, long-term, negligible, beneficial impact on the regional economy. The magnitude of the proposed spending would not be expected to have a discernable effect on the regional economy.	Similar to Alternative 2, Alternative 4 would have a local, long-term, minor, beneficial effect on the socioeconomic environment due to the beneficial effect of the improved water security system on the character of the social and economic environments. Proposed short-term construction and long-term operation and maintenance spending associated with Alternative 4 would total $2.0 million for construction and approximately $1.7 million for operation and maintenance of the proposed water system. Proposed construction and operation and maintenance spending would have a regional, long-term, negligible, beneficial impact on the regional economy. The magnitude of the proposed spending would not be expected to have a discernable effect on the regional economy.
PARK OPERATIONS AND FACILITIES			
The aging water system infrastructure at Furnace Creek would continue to be substandard in terms of reliability and water quality. These problems would be expected to increase over time as the system continues to deteriorate. Erosion from water releases from Texas Springs and the 2-million gallon tank would continue to adversely affect the effectiveness of resources management. Together, these conditions would result in a local, long-term, moderate, adverse effect on park operations.	Overall, Alternative 2 would have a local, long-term, moderate, beneficial impact on park operations and facilities due principally to water system infrastructure improvements as well as improvements in resources management associated with riparian releases. Alternative 2 would enable park operations staff to improve the quality and effectiveness of park infrastructure and, by reliably providing a water supply that meets applicable standards, better provide for a positive visitor experience.	Alternative 3 would have a local, long-term, moderate, beneficial impact on park operations and facilities due principally to water system infrastructure improvements as well as improvements in resources management associated with riparian releases. Similar to Alternative 2, Alternative 3 would enable park operations staff to improve the quality and effectiveness of park infrastructure and, by reliably providing a water supply that meets applicable state and federal standards, better provide for a positive visitor experience.	Alternative 4 would have a local, long-term, moderate, beneficial impact on park operations and facilities due to water system infrastructure improvements. Alternative 4 would enable park operations staff to improve the quality and effectiveness of park water system infrastructure in order to reliably provide a water supply that meets applicable state and federal standards.